DEPARTMENT OF CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

OUTCOME BASED EDUCATION (OBE) SYLLABUS

B.Sc. CHEMISTRY

2020 - 2021 BATCH

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE (AUTONOMOUS)

College with Potential for Excellence

Linguistic Minority Institution Affiliated to University of Madras

E.V.R. PERIYAR HIGH ROAD,

ARUMBAKKAM, CHENNAI – 600106, TAMILNADU.

D.G.VAISHNAV COLLEGE

VISION

To impart value-based quality academia; To empower students with wisdom and to charge them with rich Indian traditions and culture; to invoke the self, to broaden the same towards nation building, harmony and universal brotherhood

MISSION

To ensure sustained progress and development in imparting quality education, to pioneer new avenues of teaching and research and to emerge as an institution with potential for excellence

DEPARTMENT OF THE CHEMISTRY

VISION

To impart a sound **knowledge** in chemistry to the students that stresses scientific reasoning and problem-solving skills.

To equip students with the **skills** required to strengthen their social responsibility and to make them competent in this knowledge-driven society.

MISSION

M1	To educate students with state-of-the-art curriculum, improvised teaching methodologies and progressive research facilities. To expose students to a breadth of experimental techniques this will transform them into quality chemist.
M2	To produce socially responsible chemist who can contribute more to the industry and to address problems of societal importance. To make the department a thriving center of excellence in teaching, curriculum development and valuable research
M3	To outreach the under-privileged students of the city in the form of workshops, on-line courses, etc that showcase the role of chemistry as central science.

Eligibility for admission to B.Sc.

Pass in H.S.C or CBSE examination conducted by state board /central board with Mathematics, Physics, Chemistry as the main subjects.

Duration of course

B. Sc. (three years)

Eligibility for the award of degree

Passing of all the subjects (both in internal and ESE) offered by the college for the course.

PROGRAM EDUCATION OBJECTIVES (PEOs)

PEO1	To produce efficient and intellectual undergraduates with strong fundamentals in organic, inorganic, physical and analytical chemistry to pursue higher studies in the field of research, innovation and technology
PEO2	To make undergraduates, capable of attaining employment in teaching and industry.
PEO3	To enable undergraduates to develop professionally through life-long learning, higher education and other creative entrepreneurial pursuits in their areas of expertise or interest**.**
PEO4	
PEO5	

PEO TO MISSION STATEMENT MAPPING

MISSION STATEMENTS	**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**
M1	2	2	2		
M2	2	1	3		
M3	1	2	3		

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAMME OUTCOMES

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to :

S.NO	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
1.	**Knowledge**	Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry. **(PO1)**
2.	**Critical Thinking**	Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking. **(PO2)**
3.	**Problem Solving**	Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries. **(PO3)**
4.	**Usage of modern tools**	Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis , FTIR, NMR, GCMS, Fluorescence, SEM,TEM and XRD) for chemical analysis **(PO4)**
5.	**Communication**	Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. **(PO5)**
6.	**Life-long Learning**	Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change. **(PO6)**
7.	**Ethical Practices and Social Responsibility**	Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences. **(PO7)**
8.	**Independent and Reflective Learning**	Develop entrepreneurial skills in interdisciplinary and multidisciplinary areas of chemical sciences and its applications and develop a zeal to pursue a career in the field of chemistry.**(PO8)**

Mapping of POs TO PEOs

PEO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
PEO 1	3	2	2	2	2	2	1
PEO 2	2	2	3	1	2	2	3
PEO 3	2	3	3	2	1	1	3
PEO 4	3	2	2	2	1	1	2
PEO 5	2	2	2	3	2	2	1

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of graduation, our under graduates would be able to:

PSO 1- Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

PSO2 - Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

PSO4 – Apply the knowledge of Chemistry to appreciate, develop and test the theoretical aspects for applications in environment, materials, medicines, and technology.

PSO5 - Employ standard laboratory equipment, instrumentation and classical techniques to carry out experiments and develop skills to interpret and explain the validity of experimental data in terms of accuracy and underlying theory.

SCHEME OF I YEAR B.SC. PROGRAM

SEM	PART	TITLE OF THE PAPER	INSTRUCTION HOURS/WEEK	DURATION OF EXAM	MAX. MARKS			CREDITS
					CIA	ESE	TOTAL	
SEMESTER-I								
I	I	Language Paper –I	6	3	40	60	100	**3**
	II	English Paper –I	6	3	40	60	100	**3**
	III	Core Paper - General Chemistry-I	6	3	40	60	100	**5**
	III	Mathematics –I	9	3	40	60	100	**5**
	V	NME- I Detection of Adulterants in food-Practical I	2	3	40	60	100	**2**
	V	Soft skill I	6	3	40	60	100	**3**
		TOTAL CREDITS						**21**
SEMESTER-II								
II	I	Language Paper –II	6	3	40	60	100	3
	II	English Paper –II	6	3	40	60	100	3
	III	Core Paper –II General Chemistry-II	6	3	40	60	100	5
	III♦	Core Paper– III Qualitative Inorganic Mixture Analysis - Practical I	3	3	40	60	100	4
	III	Mathematics –II	9	3	40	60	100	5
	V	NME – II Significance of chemistry in everyday life-Practical II	2	3	40	60	100	2
	V	Soft skill II		3	40	60	100	3
		TOTAL CREDITS						**25**

* Examination will be conducted at the end of the Semester

COURSE TITLE: CORE I - GENERAL CHEMISTRY –I

Course Code	**:**	**Credits**	**: 05**
L:T:P:S	**: 6:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

On taking this course the student will be able to assess the ideal and non-ideal behavior of gases, to apply the concepts in first law of thermodynamics to analyse given thermochemical reactions, to analyse periodic properties, to analyse anions and cations in a given sample and to apply basic concepts of organic chemistry to assess the different reactions.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Calculate the thermal energy of gases using kinetic theory of gases and it can be compared with the results of principle of equipartition of energy - Identify the distribution of molecular velocities using Maxwell equation and - calculate the mean, root mean square and most probable velocity of gases - Assess an ideal and non-ideal behaviour of gases with the help of various equation of states -Use the basic concepts of gaseous state in thermodynamic study
CO 2	Differentiate work and heat, isothermal and adiabatic processes, reversible and irreversible processes - Calculate enthalpy change for a given reaction from heat capacity data - Calculate work, heat, ΔU, ΔH, for reversible and irreversible processes from First law of thermodynamics.
CO 3	Classify metals, non-metals and metalloids - Explain chemical behaviour of the elements from periodic properties - Determine electronegativity using Pauling scale - Justify factors affecting the periodic properties
CO 4	Analyse the basic radicals in a given sample from the concepts of solubility, solubility product, and common ion effect - Estimate the amount of substance present in the whole of the given solution from the principles of volumetric analysis
CO 5	Compare the stability of intermediates, acidity of carboxylic acids, basicity of amines from polar effects - Assess the chemistry of alkanes - Differentiate Conformation and configuration

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	3	3	2	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	2	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 5	3	3	3	2	3	3	3	2	3	3	3	3	2
CO 6	3	3	3	2	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No	CONTENTS OF MODULE	Hrs	COs
1	**GASEOUS STATE** 1.1 Gas laws - kinetic theory of gases –collision frequency- collision diameter – mean free path – collision number – equipartition of energy – molecular basis of heat capacity 1.2 Transport properties – diffusion, elementary ideas of thermal conductivity and viscosity of gases. 1.3 Maxwell's Distribution of molecular velocities (no derivation) – Derivation of the expression for mean, root mean square and most probable velocity. 1.4 Real gases- compressibility factor- deviation from ideality- different equations of state- derivation of Van der Waal's equation of state – Andrew plot-consequences of Vander Waals equation of state-– derivation – critical constants –Relationship between critical constants and Vander Waals constants-continuity of state. 1.5 Virial equation of State – Law of corresponding states – Boyle Temperature	15	CO1
2	**THERMODYNAMICS 1** 2.1 System and surrounding – Isolated, closed and open systems	15	CO2

	2.2 Intensive and extensive variables. Thermodynamic equilibrium-thermodynamic state Thermodynamic processes - isothermal & adiabatic processes – State and path functions .Exact and inexact differentials- difference between the nature of heat and work. 2.3 Work of expansion at constant pressure – comparison of work done in single stage, two stage, and multistage expansion and compression–reversible and irreversible processes - free expansion. 2.4 Statement of zeroth law of thermodynamics. 2.5 Internal Energy (E) and its properties- Perpetual motion machine I - The first law of 2.6 Thermodynamics- limitations changes in energy at constant volume- Joules experiment. 2.7 Enthalpy (H) – properties -difference between internal energy and enthalpy. Practical relevance of enthalpy over internal energy. Heat capacity. Relation between Cp and Cv for ideal and real gases. Calculation of enthalpy changes from heat capacity data. 2.8 Calculation of w, q, ΔE and ΔH for expansion of ideal gases under isothermal and adiabatic conditions of reversible and irreversible processes.-related problems		
3	**ELECTRONIC CONFIGURATION & PERIODIC PROPERTIES** 3.1 Aufbau principles *(n+l)* rule- Hund's rule – Pauli's exclusion principle- stability of half and fully filled orbitals – anomalous electronic configuration. 3.2 Classification of elements as s, p, d and f blocks-types of elements-metals, non metals and metalloids; trend in the periodicity of properties on going down a group and across a period. 3.3 Atomic radius-covalent radius, vander walls radius, metallic radius, atomic radii of noble gases-Ionic radius –determination of ionic radius based on effective nuclear charge- applications in explaining the chemical behaviour- Ionization potential-factors affecting ionization potential, applications in explaining the chemical behaviour- Electron affinity- factors affecting electron affinity, applications in explaining the chemical behaviour.	**15**	**CO3**

	3.4 Electro negativity- determination of electronegativity-Pauling's scale factors affecting electro negativity, applications of electronegativity in explaining the nature of chemical bond. Change in metallic and non-metallic behaviour in the periodic table.		
4	**PRINCIPLES OF INORGANIC QUALITATIVE AND VOLUMETRIC ANALYSIS** 4.1 Solubility and solubility products -relation between solubility and solubility product-use of solubility products in comparing relative solubilities of salts - common ion effect -their application in cation analysis. 4.2 Separation of group II and IV groups using H_2S method-uses of NH_4Cl in III group separation. 4.3 Expression of concentration-mole, molecular weight, equivalent weight, molarity, normality, formality, *molality*, percentage, mole fraction, ppm, ppb. (simple problems based on above concepts) - primary and secondary standards. 4.4 Types of indicators with examples- choice of indicators-adsorption indicators-Types of titrations- acid base (strong acid and strong base; strong acid and weak base-only).	**15**	**CO4**
5	**BASIC CONCEPTS OF ORGANIC CHEMISTRY** 5.1 IUPAC nomenclature - Alkanes, alkenes, alkynes, functional groups up to 8 C atoms 5.2 Temporary effects – polarizability effects - electron displacement - electromeric and inductomeric effects - Permanent effects – polar effects – inductive, mesomeric effects – difference between mesomerism and resonance - Hyper conjugation, steric and field effects, ortho – effect. 5.3 Hybridization and geometry- methane, ethane, ethylene, acetylene, benzene. 5.4 Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals, carbenes and nitrenes (basic idea). 5.5 Chemistry of alkanes – preparation – advantage of Corey – House synthesis over Wurtz reaction - Concept of Umpolung and use of Gilman reagent – Kumada coupling.	**15**	**CO5**

	5.6 Chemical properties – free radical mechanism of halogenations sulphonation – interconversion of ethane and butane 5.7 Cycloalkanes – preparation from dihaloalkanes and Dieckman method – properties – reaction with H_2, X_2, and HX 5.8 Relative stabilities of cycloalkanes – Difference between Configuration and Conformation - cyclopropane to various forms of cyclohexane – Bayer's strain theory		
6	**ALKENES, ALKYNES AND DIENES** 6.1 Preparation of alkenes – Wittig reaction 6.2 Properties of alkenes – electrophilic and radical additions – general mechanisms -E1, E2 and E1cB- reactions- illustration and mechanism with standard examples. A brief study of Reactivity of substrate, structure, nature of base, temperature, and solvent - Hofmann & Saytzeff rules. 6.3 Reactions: syn-addition (alk. $KMnO_4$) and anti-addition (bromine), Addition of HX (Markovnikoff's and anti-Markovnikoff's addition), Hydration, Ozonolysis, oxymecuration - demercuration, Hydroboration - oxidation. 6.4 Properties of Alkynes - Reduction of alkynes - selectivity, Heck reaction, Sonogashira reaction - Preparation of higher alkynes from acetylides and alkynyl Grignard reagents. 6.5 Acyclic and cyclic alkynes - Cycloalkenes- reaction with NBS– Cyclohexene – correct representation -description. 6.6 Dienes – Classification – Reactions of 1,3-butadiene - Acyclic dienes 6.7 Click reactions – Diels – alder and retro- Diels – alder reaction	**15**	**CO6**

REFERENCES:

1. Principles of Physical Chemistry, Puri, Sharma, Pathania 27th edn, Vishal Publishing Co, 2016
2. Advanced Physical Chemistry P.W. Atkins, 8th edition, Oxford Press, 2009.
3. Physical Chemistry 4th Edn, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, JohnWiley & Sons, Inc.,
4. A Text book of Physical Chemistry, A S Negi, S C Anand, New Age International Publishers, 2007.
5. Physical Chemistry,W. J. Moore- Longman Publishing Group; 5th edition (1998)

6. A text book of Physical Chemistry, Glasstone, 2nd edition, Macmillan
7. A text book of physical chemistry: KL Kapoor (Volume 2 & 3), McGraw Hill Education (for Thermodynamics)
8. Physical Chemistry, Gilbert W. Castellan, 3rd edition, Narosa (for Thermodynamics and Gaseous state)
9. Puri B.R., Sharma L.R., Kalia K.K Principles of Inorganic chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand Co 1993.
10. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
11. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).
12. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)
13. IGNOU materials for undergraduate courses for all the topics (materials can be downloaded from the following website. (www.egyankosh.ac.in) IGNOU school of sciences- levels -bachelor degree programs - current BSC- (general): full content download (.zip/.rar) elective course in chemistry (English) view/open)
14. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984) (for Unit 4 and inorganic qualitative analysis practicals)
15. Vogels text book of quantitative chemical analysis. Fifth edition or sixth edition
16. NPTEL video lectures.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze	-	-	5	-
Evaluate	-	-	-	-
Create	-	-	-	-

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	-
Create	-

COURSE TITLE: CORE II - GENERAL CHEMISTRY – II

Course Code :		**Credits**	**: 05**
L:T:P:S	**: 6:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

On taking this course the student will be able to interpret the different properties of solids, to analyse thermo chemical reactions, to assess the nature of chemical bonding, to analyse properties of s- block elements, and to assess the reactions involved in aromatic and halogen compounds.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Calculate packing fraction, radius ratio, density of crystals – Determine interplanar distance in crystals from X-ray diffraction data - Explain the conductance of insulators, semiconductors, superconductors
CO 2	Calculate heat of reaction, heat of solution, heat of dilution, bond energy, bond enthalpy for a given thermochemical reaction from thermodynamic data.
CO 3	Calculate lattice energy from Born-Haber cycle and assess the factors affecting lattice energy - Determine the hybridisation and shapes of simple inorganic molecules from VSEPR and VB theory - Sketch the Molecular orbital diagram for homo and hetero diatomic molecules.
CO 4	Analyse physical and chemical properties and applications of alkali and alkaline earth metals - Compare stabilities of carbonates of alkaline earth metals - Compare the solubility of sulphates of alkaline earth metals - Restate the special position of hydrogen in the periodic table
CO 5	Compare the stability of intermediates from the concept of aromaticity - Assess the mechanism of electrophilic substitution reaction in polynuclear hydrocarbons and it's reactivity towards the same reaction.
CO 6	Assess the mechanism of S_N1, S_N2, and S_Ni reactions and analyse the effect of substrate structure, base, temperature, solvent, nucleophiles towards the same reactions - Analyse the reactions of halogen derivatives and poly halogen derivatives.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	3	3	2	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	2	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 5	3	3	3	2	3	3	3	2	3	3	3	3	2
CO 6	3	3	3	2	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1 Solid State Chemistry** 1.1 Crystalline solids, space lattice, Unit cell, seven crystal system, Bravaise lattices, close packing of crystals. 1.2 Packing fraction, radius ratio calculation, stability of ionic crystals-density of crystals, Miller indices, interplanar spacing- X-ray diffraction, Laue method and Debye-Scherrer (powder) method-intensities and structural determination of sodium chloride. 1.3 Bragg's equation, application of Bragg's equation to cubic crystal systems (simple cubic, BCC and FCC). 1.4 Classification of materials based on electrical conductivity- Metallic conductors- Theories of metallic bonding- Electron gas, Pauling and band theories-Semi conductors-n-type and p-type- applications-rectifiers, transistors, LED. 1.5 Super conductors- introductory ideas	**20**	**CO1**
	Unit 2 Thermodynamics 2 2.1 Relation between heat of reaction at constant volume (q_v) and at constant pressure (q_p) –heat of reactions-heat of formation and standard states		

2	2.2 Hess law and its relationship with first law of thermodynamics – applications- calorimetry-determination of heat of reactions 2.3 Temperature dependence of heat of reaction – Kirchhoff's equation – calculation from heat capacity data – problems. 2.4 Bond energy and resonance energy - calculation from thermo chemical data 2.5 Integral and differential heats of solution and heat of dilution.	**10**	**CO2**
3	**Chemical Bonding** 3.1 Ionic bond – conditions for the formation of ionic bond-characteristic of ionic compounds-Lattice energy – Born-Haber cycle, Born-Lande equation (no derivation)-factors affecting lattice energy, solubility comparing hydration and lattice energy 3.2 Covalent bond – bond polarity- characteristics of covalent compounds-polarizing power and polarisability- Fajan's rule-deviation from the octet rule-incomplete octet-expansion of the octet (hyper valence). 3.3 VSEPR theory for $BeCl_2$, BF_3, SO_2, SO_3, PCl_5, SF_6, NH_3 and H_2O molecules. 3.4 Coordinate valency - General characteristics of compounds containing coordinate compounds. 3.5 VB theory – assumptions-limitations-principles of hybridization – shapes of simple inorganic molecules – BeF_2, BCl_3, NH_3, PCl_5, SF_6, H_2O, IF_5 and IF_7. 3.6 MO theory –conditions for the combination of atomic orbitals -LCAO-energy levels of MOs-rules for the filling of electrons in MOs- MO energy level diagrams of homo diatomic molecules- H_2, He_2, C_2, N_2, O_2, hetero diatomic molecules –HF, NO and CO. 3.7 Comparison of VB and MO theories, Hydrogen bonding – types, nature of hydrogen bond-effects of hydrogen on properties of substances. (H_2O and H_2S; HCl and HF; ortho- and *para*-nitro phenols; *ortho, meta and para*-hydroxy benzaldehyde; 2-nitro resorcinol; triethylamine and dimethyl amine).	**15**	**CO3**
	Unit 4 Chemistry of s-Block Elements 4.1 General characteristics of IA and II A group elements-electronic configuration – atomic and ionic radii- ionization potential-metallic character- electro negativity-polarising power- hydration ion and		

4	hydration energy-flame coloration- diagonal relationship- action with water, halogens and ammonia-formation of hydrides, oxides and complex compounds. 4.2 Extraction- sodium by Down's process-magnesium by electrolysis of fused magnesium chloride. Physical and Chemical Properties, and uses of Li, Na, K, Be, Mg and Ca. 4.3 Chemical Properties and uses of plaster of paris, bleaching powder and sodium bi-carbonate. Comparison of stability of II group carbonates and solubility of sulphates. 4.4 Position of hydrogen in the periodic table- resemblance with alkali metals -special position of hydrogen.	**15**	**CO4**
5	**Unit 5 Chemistry of Benzene and Poly Nuclear Aromatic Hydrocarbons.** 5.1 Aromaticity – Huckel's rule – Examples aromatic ,non-aromatic and antiaromatic compounds - Non benzenoid aromatic compounds. 5.2 Aromatic electrophilic substitution – mechanism – nitration – sulphonation – halogenations – Friedel-Crafts alkylation and acylation - orientation and reactivity in mono – and di – substituted benzenes – o/p ratio 5.3 Polynuclear hydrocarbons – Orientation and reactivity of naphthalene - structural elucidation and Haworth synthesis– chemical properties. 5.4 Orientation and reactivity of Anthracene and phenanthrene - Importance of 9- and 10- positions. Anthracene – oxidation, Diels-Alder reaction and reaction with Benzyne	**15**	**CO5**
6	**Unit 6 Halogen Derivatives** 6.1 Preparation of Halogen derivatives from alcohols using HX, PX_3, PX_5 and $SOCl_2$. 6.2 S_N1, S_N2 and S_Ni reactions – illustration & mechanism with examples – Effect of substrate, base, temperature, solvent and nucleophiles in S_N1 & S_N2 reactions- Basicity Vs nucleophilicity. 6.3 Reactions of halogen derivatives-hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation, thiocyanide and isothiocyanide. Williamson's ether synthesis- Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides	**15**	**CO6**

	6.4 Polyhalogen derivatives - Geminal and vicinal halides - Preparation of 1,1 and 1,2-dichloroethane from acetaldehyde & Phosporous halides , percarbonate and perborates. 6.5 Aromatic nucleophilic substitution – S_NAr and Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$)–Addition - elimination and Elimination – addition mechanism. 6.6 Preparation of aryl halides by Schiemann reaction, chloro and bromo - Sandmeyer & Gattermann reactions.		

REFERENCES:

1. Principles of Physical Chemistry, Puri, Sharma Pathania 7th edn, Vishal Publishing Co, 2016
2. Physical Chemistry: Robert G. Mortimer 3rd edition, Elsevier Academic Press, 2008.
3. Advanced Physical Chemistry P.W. Atkins Oxford Press. 1990
4. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, John Wiley & Sons, Inc.,
5. A Text book of Physical Chemistry, A S Negi, S C Anand, , New Age International Publishers, 2007.
6. Physical Chemistry, W. J. Moore- Longman Publishing Group; 5th edition (1998)
7. A text book of Physical Chemistry, Glasstone, 2nd edition, Macmillan
8. A text book of physical chemistry: KL Kapoor (Volume 2 & 3) McGraw Hill Education
9. Physical Chemistry, Gilbert W. Castellan, 3rd edition , Narosa
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11. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
12. Pillai C. N., Textbook of Organic chemistry for undergraduates, University press (2008).
13. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., NewDelhi (1997)
14. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967). Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)
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ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

COURSE TITLE: CORE III INORGANIC QUALITATIVE ANALYSIS

Course Code :	**Credits : 04**
L:T:P:S : 6:0:0:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

LEARNING OBJECTIVES:

On taking this course, the student will be able to analyse acid radicals and basic radicals in a given inorganic mixture by systematic semimicro qualitative analysis

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Identify the interfering and non-interfering anions (Acid radicals) in a given inorganic mixture systematically by semimicro qualitative analysis
CO 2	Eliminate interfering radical to analyse cations (Basic radicals)
CO 3	Identify cations in a given mixture from the knowledge of solubility, solubility product and common ion effect

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No	CONTENTS OF MODULE	COs
1	1.1 Analysis of mixture containing two cations and two anions one of which will be an interfering ion. Semimicro methods using conventional scheme may be adopted. **Reactions of the following anions to be studied.** 1.2 Carbonate, Sulphide, Sulphate, Fluoride, Chloride, Bromide, Nitrate, Oxalate, Phosphate, Borate, Iodide*, Arsenite, Arsenate*, Chromate*, Sulphite*, Thiosulphate*, Nitrite*. 1.3 **Reactions of the following cations to be studied.** Lead, Silver*, Mercury*, Copper, Tin*, Antimony*, Cadmium, Bismuth, Aluminium, Chromium*, Iron, Manganese, Zinc, Cobalt, Nickel, Calcium, Strontium, Barium, Magnesium and Ammonium. *Not for Examination	**CO 1** **CO 2** **CO 3**

NOTE: Practical Examination will be conducted at the end of II semester.

REFERENCES:

1. Vogel, Text book of Inorganic quantitative analysis.
2. Inorganic semimicro qualitative analysis, V V Ramanujam, the national publishing company, 3rd edn, 2007
3. Basic principles of practical chemistry, Venkateswaran, Veeraswamy and Kulandaivel, S. Chand & Co
4. Practical Chemistry- Volume 1, Dr. S. Sundaram, Dr.P.S. Raghavan and Dr. P. Krishnan, Viswanathan publishers.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

COURSE TITLE: NME – I DETECTION OF ADULTERANTS IN FOOD PRACTICAL-I

Course Code :		**Credits**	**: 02**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Learning Objectives:

To impart practical knowledge to detect the common adulterants in food stuffs

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Identify the glassware commonly used in the Chemistry laboratory and know how to properly utilize the glassware (K1)
CO2	Recognize the colors and adulterants present in foods and beverages (K1)
CO3	Classify the food additives and discuss their functions (K2)
CO4	Analyse the food products and identify the adulterants (K4, K1)

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**2**	**2**	**2**	**2**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No.	CONTENTS OF MODULE	Hrs	COs
1	**LIST OF EXPERIMENTS** 1.1 Detection of starch in milk. 1.2 Detection of neutralizers in milk. 1.3 Detection of mashed potato in ghee. 1.4 Detection of hidden insect infestation (Ergot) in food grains. 1.5 Detection of chalk powder in wheat powder. 1.6 Detection of washing soda in sugar. 1.7 Detection of sugar solution in honey. 1.8 Detection of coal tar dyes (Malachite green) in green vegetables/peas 1.9 Detection of chalk powder in asafoetida. 1.10 Detection of mineral acid (other than phosphoric acid) in soft drinks. 1.11 Detection of coal tar dyes (metanil yellow) in food stuffs 1.12 Detection of Sodium bicarbonate in Jaggery. 1.13 Detection of prohibited colours in edible oil. 1.14 Detection of metanil yellow in turmeric powder. 1.15 Detection of Rhodamine B in processed foods (sweets/ syrup).	**30**	**CO1, CO2, CO3, CO4**

TEXT BOOKS:

1. Lab Manual, Prepared by Department Staff, Department of Chemistry, DGVC

REFERENCE BOOKS:

1. G. D. Gem Mathew, CHEMISTRY IN EVERYDAY LIFE

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	**MODEL**	**ESE**
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

COURSE TITLE: SIGNIFICANCE OF CHEMISTRY IN EVERYDAY LIFE –II

Course Code :		**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVE:

To impart practical knowledge on the chemistry aspects which plays an integral role in our daily life?

COURSE OUTCOMES:

At the end of the Course, the Student will be able to:

CO1	Determined the pH of the soft drink and shampoo whether the acid or base
CO2	Identified the soil are acid or base which type of soil are suitable for agriculture
CO3	Determined the quality of in various commercial available milk product
CO4	Understand adsorption concept involved in activated charcoal
CO5	Redox reaction and Equilibrium reaction and non equilibrium reaction
CO6	Determination of unknown glucose solution using clock reaction
CO7	Estimation of iron in adulterated tea powder (iron fillings) and Thin layer chromatographic analysis of stic pens/ gel pens.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**2**
CO2	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO4	**3**	**2**	**2**	**3**	**1**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**
CO6	**3**	**2**	**2**	**3**	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**
CO7	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE	COs
1	Electrochemistry: Determination of pH of soft drinks using pH paper.	**CO1**
2	Electrochemistry: Determination of pH of shampoos using pH paper.	**CO1**
3	Soil chemistry: Testing Soil pH Using Vinegar and Baking Soda.	**CO1**
4	Soil chemistry: Testing Soil pH Using Red cabbage.	**CO2**
5	Surfactant science : make a milk rainbow	**CO3**
6	Surface chemistry: Adsorption of metal ion (iron) using activated charcoal.	**CO4**
7	Reversible Redox reaction: blue bottle reaction explains the concept of equilibrium.	**CO5**
8	Redox reaction: Determination of unknown glucose solution using clock reaction.	**CO6**
9	Food chemistry: Estimation of iron in adulterated tea powder (iron fillings).	**CO7**
10	Forensic science: Thin layer chromatographic analysis of stic pens/ gel pens.	**CO7**

REFERENCES

1. http://chemistry.about.com/od/chemistry101/f/importanceofchemistry.htm Chemistry is present in every aspect of life, and here we can see a few examples. There are articles about the chemistry of everyday life, and also a few about physics, as it's also present in our daily life
2. http://www.novapdf.com

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

SCHEME OF II YEAR B.SC. PROGRAM

SEM	PART	TITLE OF THE PAPER	INSTRUCTION HOURS/WEEK	DURATION OF EXAM	MAX. MARKS			CREDITS
					CIA	ESE	TOTAL	
SEMESTER-III								
III	I	Language III	6	3	40	60	100	3
	II	English III	6	3	40	60	100	3
	III	Core Paper IV General Chemistry III	6	3	40	60	100	5
	III	Allied Paper -Chemistry– I (for Mathematics and Physics- Major)	5	3	40	60	100	**5**
	III	Allied Paper -Chemistry– I (for Botany- Major)	5	3	40	60	100	**5**
	V	Environmental Studies		3	40	60	100	--
	V	Soft Skill		3	40	60	100	3
		TOTAL CREDITS						**24**
SEMESTER-IV								
IV	I	Language Paper IV	6	3	40	60	100	3
	II	English Paper IV	6	3	40	60	100	3
	III	Core Paper V General Chemistry IV	6	3	40	60	100	5
	III ♦	Core Paper VI Volumetric Analysis and Inorganic preparations- Practical II	**3**	**3**	40	60	100	**4**
		Summer Internship						**2**
	III	Allied Paper -Chemistry– II (for Mathematics and Physics- Major)	**5**	**3**	40	60	100	**5**
	III	Allied Paper -Chemistry– II (for Botany- Major)	**5**	**3**	40	60	100	**5**
	III	Practical-Allied Chemistry (for Mathematics, Physics and Botany-Major)	**3**	**3**	40	60	100	**4**
	V	Environmental Studies		**3**	40	60	100	**2**
	V	Soft skill		**3**	40	60	100	**3**
		TOTAL CREDITS						**36**

COURSE TITLE: CORE IV – GENERAL CHEMISTRY- III

Course Code :		**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVE:

To impart basic knowledge in thermodynamics, partial molar properties, *p- block elements, and organic derivatives.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the II law of Thermodynamics, necessity for the II law, different statements of II law, Carnot cycle, concept of entropy, including Clausius inequality, Gibb's free energy, Helmholtz free energy, Gibb's-Helmholtz equations and its applications.
CO2	Explain the concept of partial molar properties.
CO3	Explain the different laws for ideal solution (Raoult's law & Henry's law), discuss about non ideal solution, azeotropes, partially miscible liquid systems Discuss the various colligative properties and methods of determining them.
CO4	Discuss about partially miscible liquid systems (phenol-water, water-triethylamine, water-nicotine) and partition coefficient
CO5	Explain the general periodic trend, preparation and properties of electron deficient boron compounds, difference between carbon and silicon from the rest of the family.
CO6	Explain types of oxides and oxyacids, their structure and reactivity of nitrogen, oxygen. Discuss the periodic properties and reactivity of halogen family. Explain the properties of interhalogen compounds and pseudo halogens. Explain the periodic position of noble gases, structure and properties of Xenon compounds
CO7	Explain the methods of preparation and properties of aliphatic alcohols, phenols and polyhydric phenols.
CO8	Explain the classification, preparation and properties of alkyl and aryl ethers. Discuss the preparation, properties of epoxides and importance of crown ethers.
CO9	Explain the reactivity of carbonyl compounds, preparation, oxidation and reduction of aldehydes and ketones.
CO10	Discuss the preparation of dialdehydes and diketones.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	1	2	1	3	2	3	2	3	2
CO2	3	3	3	1	2	2	1	3	3	2	2	3	3
CO3	3	3	3	1	1	2	2	3	2	3	2	3	2
CO4	3	3	3	1	2	2	3	3	3	2	2	3	3
CO5	3	3	3	3	1	2	2	3	3	2	2	3	3
CO6	3	3	3	2	1	2	1	3	2	3	2	3	2
CO7	3	3	3	3	2	3	3	3	3	2	2	3	3
CO8	3	3	3	3	1	1	1	3	2	3	2	3	2
CO9	3	3	3	1	1	1	1	2	3	2	2	3	3
CO10	3	3	3	3	2	2	1	3	2	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1 Thermodynamics 3** 1.1 Second Law of Thermodynamics: Need of the law , Kelvin plank and Clausius statements of second law. Carnot's cycle and efficiency of Carnot engine, Carnot's theorem, Thermodynamic scale of temperature. 1.2 Concept of Entropy: qualitative relationship between entropy change and unavailable heat or degraded energy - entropy change, randomness, disorderness and irreversibility. Clausius inequality-proof, Entropy criterion for spontaneous and equilibrium processes in isolated systems, Entropy as a function of P, V and T, Entropy changes during phase changes , Entropy of mixing and entropy change of chemical reactions. 1.3 Free energy: Gibb's free energy (G) and Helmholtz free energy (A), practical relevance of ΔG and ΔA, Free energy criterion for	**15**	**CO1, CO2**

	spontaneous and equilibrium process. Variation of A and G with P, V and T, Gibb's Helmholtz equation and its applications, Thermodynamic equation of state-coefficient of thermal expansion (α) and coefficient of compressibility(β), derivation of thermodynamic parameters from α and β, Maxwell's relations. 1.4 Systems of variable composition: Partial molar quantities, Chemical potential, Variation of chemical potential with T, P and Gibb's - Duhem equation.		
2	**Unit 2 Solutions** 2.1 Ideal solutions: Solutions of gases in liquids-Henry's law, solutions of liquids in liquids- Binary liquid mixtures-Ideal solutions, Raoult's law, Vapour pressure Vs composition curves 2.2 Non ideal solutions: Deviations from ideal behaviour- non ideal solution- temperature Vs vapour pressure curves- azeotropic mixture - azeotropic distillation. 2.3 Dilute solutions: colligative properties- thermodynamic derivation of lowering of vapour pressure, elevation of boiling point and depression of freezing point- osmotic pressure – abnormal colligative properties- calculation of molecular weight –vant Hoff factor. Critical solution temperature-phenol-water system, Nicotine - Water system -Triethylamine-water system. Effect of impurity on CST. 2.4 Partially miscible liquids-upper critical solution temperature (UCST) and lower critical solution temperature (LCST)- Immiscible liquids-Nernst distribution law – Thermodynamic derivation and applications.	**15**	**CO3, CO4**
3	**Unit 3 p-Block Elements 1** General periodic trend-electronic configuration-oxidation state-atomic and ionic radii-ionisation energy-metallic character-inert pair effect-lewis acid character and nature of oxides. Boron family: periodic discussion-similarity and dissimilarity of boron with aluminium - diagonal relationship of boron with silicon. Electron deficient boron compounds- preparation, properties, structure and uses of Diborane, Borazole and Boron nitride.	**15**	**CO5**

	Carbon family: periodic discussion- similarity-electronic configuration-valency- oxidation state-formation of complexes-allotropy (diamond and graphite only) -gradation in properties-electropositive character, nature of oxides, nature of hydrides, nature of halides. Difference of carbon and silicon from the rest of the family - catenation.		
4	**Unit 4: p-Block Elements 2** 4.1 Nitrogen family: Periodic trend-Similarity- electronic configuration, valency, oxidation states, allotropy, characteristics of oxides, oxyacids, hydrides, and halides 4.2 Unique feature of nitrogen from the rest of the family-valency-oxidation state- Preparation, properties, structures and uses of hydrazine, hydroxylamine and hydrazoic acid. Structure, properties and uses of PCl_3, PCl_5, P_4O_6, P_4O_{10}, H_3PO_2, H_3PO_3 and H_3PO_4. Application of the covalency maxima to halides of N and P-Maximum covalency rule- concept of overlapping of atomic orbitals. 4.3 Oxygen family: Periodic discussion-Similarity- electronic configuration, valency, oxidation states, allotropy, atomicity, catenation, characteristics of oxides, oxyacids, hydrides, and halides (dihalides, tetrahalides, hexahalides, dimeric monohalides) Abnormal behavior of oxygen. Oxides of sulphur – structure aspects of sulphur dioxide and sulphur trioxide. Peracids of sulphur- Caro's acid and Marshall's acid-preparation, properties structure and uses. 4.4 Halogen family: Periodic discussion-Similarity- electronic configuration- electronegativity, electron affinity, oxidiation states and oxidizing power - atomicity, metallic and non-metallic character-combination with hydrogen-combination with metals and non-metals-action with water-action with alkalies - oxyacids. Peculiarities of fluorine, basic nature of iodine. 4.5 Interhalogen compounds: AX type- ClF, BrF; AX_3 type- ClF_3, BrF_3, ICl_3; AX_5 type- ClF_5, BrF_5, IF_5; AX_7 type- IF_7 -properties and structure. 4.6 Pseudo halogen compounds: Preparation and properties of cyanogen and thiocyanogen. Comparison of halogens with pseudo halogens.	**15**	**CO6**

	4.7 Noble gases: Position in the periodic table- hybridisation, geometry and structure of xenon compounds- XeF_2, XeF_4, XeO_2F_2, XeO_2, XeF_6 and $XeOF_4$.		
5	**Unit 5 Hydroxy Derivatives ,Thiols And Ethers** 5.1 Alcohols-Classification, Basicity & Acidity -Preparation of alcohols Hydrogenolysis with copper chromite, Bouveault - Blanc reduction, reduction with Na/EtOH , H_2/Ni.Preparation of 1°, 2° and 3° alcohols-using Grignard reagent - Ester Hydrolysis(A_{AL}^1 ,A_{AL}^2, $A_{AC}^2$and B_{AC}^2 mechanism). Preparation from aldehydes, ketones,Carboxylicacid and esters using LAH and $NaBH_4$ 5.2 Reaction of alcohols – Esterification - Mechanism of acid and base catalyzed ester formation, Oxidation of aliphatic alcohols - use of dichromate- acidic & alkaline $KMnO_4$, hot Con.HNO_3, H_2CrO_4 , CrO_3 – Pyridine complex (PCC) - Lucas test -Oppenauer oxidation , oxidation of alcohol (diol) using HIO_4, OsO_4 and LTA 5.3 Benzyl alcohol – Preparation and chemical properties. 5.4 Preparation of Phenols - From aryl diazonium salts, Grignard reagents , cumene - Acidity of phenol –Aromatic Electrophilic substitution - Nitration, halogenation and sulphonation -Friedel crafts alkylation and acylation-ReimerTiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction. 5.5 Polyhydric phenols – Classification - Preparation of Catechol from salicylaldehyde- Resorcinol from benzene-m-disulphonic acid, p-quinol from Aniline, pyrogallol from Gallic acid. 5.6 **A**lkyl and Aryl ethers - Classification - preparation of dimethyl ether from CH_3I, Williamson ether synthesis and Tebbe synthesis, preparation of anisole using diazomethane. Preparation of acyclic and cyclic ethers by acid catalyzed dehydration of alcohols- Importance of cleavage of alkyl and aryl ethers to give alcohol . 5.7 Preparation of epoxides - using m-CPBA - Cleavage of epoxides to 1, 2 – diol. Conversion of epoxide to alcohol using RMgX (Regioselectivity) and LAH- Crown ethers - 18 – crown 6. (Elementary idea only) - Importance.	**15**	**CO7, CO8**

6	**Unit 6 Carbonyl compounds** 6.1 Carbonyl compounds –polarization and reactivity of carbonyl groups- acidity of alpha hydrogen- Nucleophilic addition – addition elimination mechanism. 6.2 Aldehydes and ketones - Preparation –from carboxylic acid and MnO, from salts of carboxylic acids, By reaction of acid halides with Lithium dimethyl cuprate, dialkyl cadmium reagents, by ketonic hydrolysis of acetoacetic ester(AAE) with dil acids, from nitriles , Benzaldehyde by Etard reaction. 6.3 Oxidation of aldehydes and ketones - Tollen's, Fehling's and Benedict reagents. MPV reductions. Clemmensen reduction and Wolff Kishner reduction -Reaction of acetone with Mg-Hg, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. 6.4 Dialdehydes – Preparation of glyoxal by oxidation of glycol - Succinaldehyde - preparation from propene via hexa 1,5-diene - formylacetone (acetoacetaldehyde) from ethyl formate and acetone (Claisen condensation) 6.5 Diketones – Preparation from acetoacetic ester (AAE) - 1, 2 - Dimethyl glyoxal (diacetyl) - preparation by oxidation of ethyl methyl ketone with SeO_2 – Acetylacetone (1,3) - by Claisen condensation of ethylacetate and acetone.	**15**	**CO9, CO10**

REFERENCE BOOKS:

1. Principles of Physical Chemistry, Puri, Sharma Pathania 7th edn, Vishal Publishing Co, 2016
2. Physical Chemistry: Robert G. Mortimer 3rd edition, Elsevier Academic Press, 2008.
3. Puri B.R., Sharma, L.R., Kalia, K., Principles of Inorganic Chemistry 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993)
4. Lee J. D., Concise Inorganic Chemistry, UK, Blackwell science (2006)
5. Madan, R.D., Tuli,G.D Malik.W.U . Principles of Inorganic Chemistry, S.Chand, 1999.
6. Inorganic Chemistry III Edition, by Miessler, G. L. and Tarr, D. A. 2004.
7. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)

8. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., NewDelhi (1997)
9. T. W. Graham Solomons, Craig B. Fryhle, Scott A. Snyder ., Organic Chemistry, 1st edition, Wiley(2017)
10. Janice Gorzynski Smith., Organic Chemistry, 5th Edition, New Delhi, Mc-Graw-Hill International Book Company, New Delhi (2010)
11. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (2010)
12. Finar I.L., Organic Chemistry, Vol 1, 6th edition, Addison Wesley Longman Ltd., England (1996)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

COURSE TITLE: CORE V – GENERAL CHEMISTRY IV

Course Code :		**Credits**	**: 05**
L:T:P:S	**: 6:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

To impart basic knowledge in thermodynamics, phase study, d- block elements, coordination compounds and organic derivatives.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1.	To contribute the first and second law of thermodynamics to equilibrium of reactions and to discuss the concept of entropy. [K3]
CO 2	To deduce the phase rule and interpret the same for various binary and ternary mixture[K4]
CO 3.	To infer the periodic properties and discuss the concentration of ores for the extraction of metals. [K5]
CO 4.	To distinguish the optical and geometrical isomerism of co-ordination complexes[K3]
CO 5.	To discuss the preparation and properties of carboxylic acids.[K3]
CO 6.	To discuss the amines, nitro and heterocyclic compounds.[K3]

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	2	3	2	2	2	3	3	3	3	3	2
CO2	3	3	2	3	2	3	2	2	2	3	3	3	3	3	2
CO3	3	3	3	3	2	3	2	3	2	3	3	3	2	3	2
CO4	3	3	3	2	2	3	2	2	2	3	3	3	2	3	2
CO5	3	3	3	3	2	3	3	3	2	3	3	3	2	3	2
CO6	3	3	3	2	2	3	2	2	2	2	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	Cos
1	**Unit 1: Applications Of Thermodynamics To Equilibrium** 1.1 Chemical equilibrium –thermodynamic derivation of equilibrium constant- equilibrium constant for various homogeneous and heterogeneous equilibria. 1.2 The relationship between Equilibrium constant and free energy change – Vant Hoff reaction isotherm –The direction of chemical change. 1.3 K_p and K_c for the formation and dissociation equilibria of NH_3, $CaCO_3$ and PCl_5 1.4 Variation of equilibrium constant Kp and Kc with temperature (Vant Hoff equation or vant hoff isochore) – applications. Variation of equilibrium constants with pressure and catalyst and the principle of microscopic reversibility. 1.5 Le-Chatelier principle-Factors affecting chemical equilibrium (Concentration, temperature, pressure and addition of inert gases) –a case study of synthesis of ammonia 1.6 Third Law of Thermodynamics: Nernst heat theorem – Statement of III law – Evaluation of absolute entropy from heat capacity data with examples(N_2 and O_2). Exception to III law-The concept of residual entropy and its calculation from Boltzman law for ortho and para hydrogen, CO, N_2O and ice.	**15**	**CO1**
2	**Unit 2: Phase Study** 2.1 Definition of terms in the phase rule –phase, components and degrees of freedom with examples. 2.2 Equilibrium- physical equilibrium of one component system – Clapeyron equation and Clausius – Clapeyron equation for various phase equilibria. 2.3 Derivation of phase rule- Phase diagram and Application of phase rule to one component system- water and CO_2 – super cooling, sublimation. 2.4 Reduced phase rule for condensed systems- Phase diagram of two component systems – solid liquid equilibria, simple eutectic (Pb-	**15**	**CO2**

	Ag & Bi-Cd), desilverisation of lead –Compound formation with congruent melting point. (Mg-Zn) and incongruent melting point (Na-K). Freezing mixtures – $FeCl_3$-H_2O and $CuSO_4$-H_2O systems.		
3	**Unit 3: d-Block Elements** 3.1 Definition of a transition element-General periodic trend- study of First transition series- Electronic configuration, metallic character, atomic radii, standard electrode potential, stability of different oxidation states of transition metal ions in aqueous solution, reactivity, oxidation states, formation of coloured complexes, magnetic properties, catalytic properties, formation of non-stoichiometric compounds, interstitial compounds, alloy formation. Coinage metals-Cu, Ag and Au. 3.2 Metallurgy : Definition-Classification of ores- metallurgical processes-: concentration of the ore-hand picking, gravity separation (Wifley table method, hydraulic classifier), magnetic separation-Electrostatic separation, froath floatation-Chemical separation; calcinations, roasting; Ellingham diagram-reduction to free metal-smelting- reduction by controlled heating in air (auto reduction)-reduction by aluminium. Electrometallurgy-Amalgamation method, hydrometallurgy. Fluxes- acidic and basic. Refining of metals- Zone refining, electrolytic refining, vapour phase, *van Arkel* process, vacuum arc furnace refining. 3.3 Extraction of titanium from Rutile and platinum from Sperrylite (Ni ore). Alloys and uses of Ti and Zr.	**15**	**CO3**
4	**Unit 4: Introduction to Coordination Chemistry** 4.1 Types of ligands- IUPAC Nomenclature- Structural Isomerism- ionization, hydrate, linkage, ligand and coordination isomerism. 4.2 Stereoisomerism-geometrical and optical isomerism of four and six coordinated complexes. Geometrical Isomerism: four coordinated complexes- $[MA_2B_2]^{n\pm}$, $[MA_2BC]^{n\pm}$, $[MABCD]^{n\pm}$, $[M(AB)_2]^{n\pm}$. Six coordinated complexes-$[MA_4B_2]^{n\pm}$, $[MA_4BC]^{n\pm}$, $[MA_3B_3]^{n\pm}$, $[MABCDXY]^{n\pm}$, $[M(AA)_2\ (B)_2]^{n\pm}$, $[M(AA)_2\ BC]^{n\pm}$, $[M(AB)_3]^{n\pm}$. (where (AA) is symmetrical bidentate ligand and (AB) is unsymmetrical bidentate ligand)	**15**	**CO4**

	4.3 Optical Isomerism: four coordinated complexes- $[M(AB)_2]^{n\pm}$. Six coordinated complexes- $[M(AA)_3]^{n\pm}$, $[M(AA)_2\ X_2]^{n\pm}$, $[M(AA)_2\ XY]^{n\pm}$, $[M(AA)\ X_2\ Y_2]^{n\pm}$.		
5	**UNIT 5: Carboxylic Acids** 5.1 Preparation of monocarboxylic acids- by oxidation of alkenes with $KmnO_4$, by oxidation of alkyl benzenes, preparation using diazomethane, Arndt-Eistert synthesis, conversion of acid to acid chlorides, alcohols, Anhydrides, Esters and Amides. 5.2 Reactions of carboxylic acids – Esterification by diazomethane, Hell Volhard Zelinski reactions. 5.3 Active methylene compounds – Preparation and Synthetic applications of diazomethane . AAE and cyanoacetic ester. 5.4 Unsaturated acids: Preparation of Acrylic acid from propanoic acid, crotonic acid from β- 41lectrop butyric acid , Cinnamic acid from malonic ester and cyanoacetic ester. 5.5 Preparation of 41lectrop acids – Reformatsky reaction – action of heat on α, β, γ & δ 41lectrop acids. 5.6 Dicarboxylic acids – Nomenclature – General preparation of dicarboxylic acids –Succinic and Glutaric acids - Preparation of adipic acid from cyclohexanone- preparation of phthalic acid from naphthalene. Conversion of adipic acid, phthalic acids to their anhydrides.	**15**	**CO5**
6	**UNIT 6: Organic Nitrogen compounds and Heterocyclic compounds** 6.1 Amines –Classification – Preparation of amines from acids (Schmidt reaction)-from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction –Reactions of amine – Distinction between primary, secondary and tertiary amines – Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. 6.2 Nitro compounds – Preparation – Difference between alkyl nitrites and nitro alkanes, distinction between primary, secondary and tertiary nitro compounds. Reduction of nitrobenzene in acidic and alkaline medium.	**12**	

	6.3 Five membered Heterocyclic compounds – Furan, Pyrrole, and thiophene – Hybridization, Basicity/Acidity, Orientation and aromaticity, Preparation, Reactivity towards 42lectrophilic and nucleophillic substitution reactions – Diels alder reaction with furan. 6.4 Six-membered heterocycles – Pyridine-Aromatic character,structure, Hybridization, basicity/acidity. Orientation and reactivity- Preparation – electrophilic and nucleophilic substitution reactions. Chichibabin reaction, Zeigler alkylation. Pyridine-N- oxide, preparation and importance.		

References:

1. Principles of Physical Chemistry, Puri, Sharma Pathania 7th edn, Vishal Publishing Co, 2016
2. Physical Chemistry: Robert G. Mortimer 3rd edition, Elsevier Academic Press, 2008.
3. Advanced Physical Chemistry W. Atkins 8th ednOxford Press. 2009
4 Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, John Wiley & Sons, Inc.,
5. A Text book of Physical Chemistry, A S Negi, S C Anand, , New Age International Publishers, 2007.
6. Physical Chemistry,W. J. Moore- Longman Publishing Group; 5th edn (1998)
7. A textbook of Physical Chemistry, Glasstone, 2nd edition, Macmillan
8. A text book of physical chemistry: KL Kapoor (Volume 2,3) McGraw Hill Education (Thermodynamics)
9. Physical Chemistry, Gilbert W. Castellan, 3rd edition, Narosa (Thermodynamics)
10. Phase rule and its applications, Suruchi, Sheza Zaidi
11. Puri B.R., Sharma, L.R., Kalia, K., Principles of Inorganic Chemistry 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993)
12. Lee J. D., Concise Inorganic Chemistry, UK, Blackwell science (2006)
13. Madan, R.D., Tuli,G.D Malik.W.U ,Principles of Inorganic Chemistry, S.Chand, 1999.
14. Inorganic Chemistry III Edition, by Miessler, G. L. and Tarr, D. A. 2004.
15. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
16. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., NewDelhi (1997)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

COURSE TITLE: CORE VI - VOLUMETRIC AND PREPARATION PRACTICAL

Course Code :	**Credits : 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

LEARNING OBJECTIVE:

To impart basic knowledge in estimation of acid- base, various metal ions by volumetric analysis, preparation of simple inorganic compounds.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Estimate the amount of metal ions like copper, silver, zinc, calcium present in the solution
CO2	Prepare various chemical compounds such as Ferrous ammonium sulphate, sodium thiosulphate pentahydrate.
CO3	Show the preparation of various concentrations of solutions from stock solution.
CO4	Differentiate the chemical substances as acid, base, oxidizing and reducing agents.
CO5	Assess the choice of indicators according to the pH involved in the titrations.
CO6	Explain the volumetric laws and concept of normality, molarity, molality, and equivalent mass

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO 6	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Acidimetry and Alkalimetry** 1. Estimation of sodium hydroxide using standard Sodium carbonate. 2. Estimation of borax using standard Sodium carbonate. 3. Estimation of mixture of Sodium hydroxide and Sodium carbonate using standard Sodium carbonate*****. 4. Estimation of Oxalic acid using standard Potassium hydrogen phthalate. 5. Estimation of total hardness of water*.	**15**	**CO1**
2	**Permanganometry** 6. Estimation of Ferrous ammonium sulphate using standard Oxalic acid. 7. Estimation of Calcium using standard oxalic acid solution.	**15**	**CO2**
3	**Iodometry** 8. Estimation of Cu (II) sulphate using standard Potassium dichromate. 9. Estimation of Potassium dichromate using standard Cu (II) sulphate.	**15**	**CO3**
4	**Argentometry** 10. Estimation of Chloride by Mohr's method. **Argentometry** 11. Estimation of Chloride by Mohr's method. **Complexometry** 12. Estimation of Magnesium sulphate using EDTA as link and Zinc sulphate as standard	**15**	**CO4**
5	**Dichrometry** 13. Estimation of Ferrous ion using standard Oxalic acid **Precipitation Titrations** 14. Estimation of Zinc using standard Potassium ferrocyanide. 15. Estimation of Barium by back titration method*****.	**15**	**CO5**

REFERENCE BOOKS:

1. Vogels Text Book of Inorganic Quantative Analysis.
2. Basic Principles of Practical Chemistry by Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A. R. 1993, Sultan Chand & Sons.
3. Practical Chemistry for UG by Sundaram, Krishnan and Raghavan.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

SCHEME OF III YEAR B.SC. PROGRAM

SEM	PART	TITLE OF THE PAPER	INSTRUCTION HOURS/WEEK	DURATION OF EXAM	MAX. MARKS			CREDITS
					CIA	ESE	TOTAL	
SEMESTER-V								
V	III	**Core Paper VII Organic** Chemistry I	**5**	**3**	40	60	100	**4**
	III	**Core Paper VIII** Inorganic Chemistry I	**5**	**3**	40	60	100	**4**
	III	**Core Paper IX** Physical Chemistry I	**5**	**3**	40	60	100	**4**
	III	**Elective Paper I –**Analytical Chemistry **OR** Pharmaceutical Chemistry	**4**	**3**	40	60	100	**5**
	IV	Value Education		**3**	40	60	100	**2**
		TOTAL CREDITS						**19**
SEMESTER-VI								
	III	**Core Paper X** Organic Chemistry II	**5**	**3**	40	60	100	**4**
	III	**Core Paper XI** Inorganic Chemistry II	**5**	**3**	40	60	100	**4**
	III	**Core Paper XII** Physical Chemistry II	**5**	**3**	40	60	100	**4**
	III	**Elective Paper II** –Applied Chemistry **OR** Industrial Chemistry	**4**	**3**	40	60	100	**5**
	III	**Elective III** – Physical chemistry practical (**OR)** Polymer chemistry						

	III♦	**Elective IV** - Gravimetric Analysis and Inorganic complex Preparation- Practical IV	**5**	**6**	40	60	100	**5**
	III♦	**Elective Paper V**- Organic Analysis and preparation- Practical V	**3**	**3**	40	60	100	**5**
	III	**Skill Enhancement Course** Analytical Chemistry Practical	**5**	**3**	40	60	100	**5**
	III	Seminar (Internal)						**02**
	III	**Open elective paper-** Chemistry in everyday life **(OR)** Food additive chemistry and five basic senses **(OR)** Food chemistry						
		Extension activities						
		TOTAL CREDITS						**33**

♦ Student should select three Elective subjects such that one elective subject in Fifth semester and two elective subjects in the sixth semester. (The elective papers are: Analytical Chemistry, Pharmaceutical Chemistry, Applied Chemistry, Industrial Chemistry, and Polymer Chemistry)

* Examination will be conducted at the end of the Semester

COURSE TITLE: CORE VII - ORGANIC CHEMISTRY-I

Course Code:	**Credits:04**
L:T:P:S:	**CIA Marks:40**
Exam Hours:03	**ESE Marks:60**

LEARNING OBJECTIVES:

This course will expose to the students, the areas of organic stereochemistry and spectroscopy. It will also provide an elementary idea about molecular rearrangements and organic dyes.

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Predict the structure and stereochemistry of simple organic compounds and analyse optical isomerism in compounds with chiral centre, chiral axis and chiral plane.
CO2	Differentiate geometrical and optical isomerism and devise conformational analysis of acyclic and cyclic systems.
CO3	Infer the fundamental laws of spectroscopy and selection rules; Interpret electronic spectroscopy and Infrared Spectra of organic molecules.
CO4	Illustrate the principle and instrumentation of NMR and to examine the spectra of simple organic molecules.
CO5	Deduce the mechanism of molecular rearrangements and cite the importance of organic dyes.

MAPPING OF COURSE OUTCOMES TO PROGRAMME OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**3**
CO5	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Stereochemistry – I** 1.1 Isomerism, stereoisomerism-Classification– Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. Conformation-definition, difference between configuration and conformation- Symmetry, asymmetry, dissymmetry, Elements of symmetry, chiral centre, stereogenic centre , chiral axis, chiral plane. 1.2 Optical isomers- Enantiomers, Diastereomers and Meso compounds. Relative and absolute configuration - Threo and erythro isomers; D and L; CIP Rules: R / S (upto 3 chiral carbon atoms). 1.3 Optical isomerism - Optical activity and chirality– Plane and circularly polarized light Criteria for optical activity – Necessary and sufficient conditions. Diastereomers – distinguishing between enantiomers and diastereomers. 1.4 Optical isomerism in compounds with chiral axis and chiral plane - allenes, spiranes Alkylidene cycloalkanes - Adamantanes and biphenyl- criteria for exhibiting chirality in each case-atropisomerism 1.5 Definition of ORD and CD	**15**	
2	**Stereochemistry II** 2.1 Geometrical isomerism: Explanation and examples with respect to carbon-carbon, carbon-hetero atom, hetero atom-hetero atom, acyclic, conjugated and cyclic compounds. Designation as Cis-Trans and E- Z notation. 2.2 Configuration of geometrical isomers – Identification of geometrical isomers using physical and chemical methods. 2.3 Conformational analysis - acyclic systems-substituted ethane, n-propane, n-butane- and cyclic systems-mono- and di-substituted cyclohexanes-Stability and optical activity of mono and di-substituted methyl cyclohexanes. 2.4 Asymmetric synthesis – partial asymmetric synthesis-Methods-with optically active Reagents, with optically active substrates- Absolute asymmetric synthesis with circularly polarized light.(Elementary idea only) 2.5 Methods of Resolution and Racemisation-Walden inversion – Evidences.	**15**	

3	**UV – VIS and IR spectroscopy** 3.1 UV- Visible spectroscopy – Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, Beer-Lambert's law- calculations involving Beer-Lambert's law 3.2 Basic principles of instrumentation for single and double beam instrument – block diagrams - description of components- Types of source, monochromator and detector- Choice of solvent. 3.3 Electronic transitions, λmax & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward Hoffmann rules for calculating λ max of conjugated dienes and α,β – unsaturated enones. (acyclic systems only) 3.4 IR spectrometry - Basic principles of instrumentation for single and double beam instrument , Block Diagram, Types of source, monochromator & detector, sampling techniques(basic idea). 3.5 Infrared radiation and types of molecular vibrations (normal modes of vibration), functional group and fingerprint region. Application of IR spectra in determining functional groups.	**15**	
4	**Nuclear Magnetic Resonance spectroscopy (NMR)** 4.1 Principle- NMR active nuclei and percentage of abundance. 4.2 Energy levels and Basic NMR equation. 4.3 Instrumentation – block diagram, NMR solvents - Use of TMS as reference 4.4 Chemical shift – Shielding and deshielding, upfield and down field-Calculation of δ,spin – spin coupling, coupling constant, Pascal's triangle – significance. 4.5 Analysis of spectrum of ethanol, acetone, acetaldehyde, ethylene, acetylene, benzene.	**15**	
5	**Molecular Rearrangements and Dyes** 5.1 Molecular rearrangements- Classification – General mechanistic treatment of nucleophilic, Electrophilic and free radical rearrangement. 5.2 Mechanism of the following rearrangements - Pinacol-pinacolone (only open chain compounds), dienone-phenol	**15**	

	rearrangement. Wagner –Meerwein, Hofmann, Curtius, Lossen and Schmidt rearrangements – Beckmann and Benzidine rearrangements. 5.3 Dyes - Phenolphthalein , methyl orange, congo red, bismark brown, malachite green, crystal violet , fluorenscein and indigo – Characterization, preparation, properties, structure and uses.		

REFERENCES & TEXT BOOKS

1. Finar I.L., Organic Chemistry, Vol. 1 & 2, 6th edition, Addison Wesley Longman Ltd., England (1996)
2. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
3. Bahl B.S., Arun Bahl., Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., New Delhi (1997)
4. Pine S.H., Organic Chemistry, 4th edition, Mc-Graw-Hill International Book Company, New Delhi (1986)
5. Seyhan N. Ege., Organic Chemistry, Houghton Mifflin Co., New York (2004)
6. William Kemp., Organic Spectroscopy, 3rd edition, Red globe press (1991)
7. Eliel E.,Wilen S.H ., Mander L.N., Stereochemistry of Carbon compounds, 2nd Edition, John Wiley & Sons., New York (1994).
8. Nasipuri., Stereochemistry of Organic Compounds, 2nd Edition, Wiley Eastern Ltd, New Delhi (1994)
9. Kalsi.P.S., Stereochemistry, Conformation Analysis and Mechanism, 2nd Edition, Wiley Eastern Limited, Chennai (1993)
10. Kalsi.P.S., Stereochemistry and Mechanism Through Solved Problems, 3rd Edition, Newage International publishers (1999)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

COURSE TITLE: CORE VIII - INROGANIC CHEMISTRY I

Course Code :		**Credits**	**: 04**
L:T:P:S	**: 6:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Learning Objective*: This course provides an ideal platform to explain the periodic properties of inner transition elements, theories of co-ordination compounds, concepts of bonding in organometallic chemistry, bio inorganic Chemistry and introduction to solid state chemistry.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1.	**To assess the** concept of electronic arrangement, various oxidations states and their exclusive magnetic properties of lanthanides and actinides [K2]
CO 2	**To predict** the shape, geometry, hybridisation, magnetic properties and stability of various six and four membered octahedral and square planar complexes of 3d series transition metals. [K2]
CO 3.	**To discuss the** about the origin and concept of pollution arising from metals and chemicals which affects the environment that includes biosphere, hydrosphere, atmosphere and lithosphere. [K3]
CO 4.	**To acquire** knowledge on the various donor systems donating sigma and pi bonds involved in the structure, bonding and properties pertaining to utility nature of organometallic compounds comprising of Pb, Zn, Li Cu and B. [K3]
CO 5.	**To distinguish** the structure of solids as hcp/ccp based on the arrangement of atoms in the crystal lattice and establish the nature of the crystal lattice as FCC or BCC or SCC[K2].

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	2	3	2	2	2	3	3	3	3	3	2
CO2	3	3	2	3	2	3	2	2	2	3	3	3	3	3	2
CO3	3	3	3	3	2	3	2	3	2	3	3	3	2	3	2
CO4	3	3	3	2	2	3	2	2	2	3	3	3	2	3	2
CO5	3	3	3	3	2	3	3	3	2	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Chemistry of Inner Transition Elements** **Position in the periodic table.** 1.1 **Lanthanoids:** General characteristics - Electronic configuration, oxidation states, oxidation potential, color, magnetic properties, basic character, solubility of compounds, double salts, chemical reactivity, formation of complex compounds, spectral properties, ionization potential. Lanthanide contraction-consequences. 1.2 **Actinoids:** General characteristics - Electronic configuration, oxidation states, atomic radii, ionic radii, actinide contraction, formation of complex compounds, magnetic properties, spectral properties, chemical reactivity. Similarities and differences between lanthanides and actinides. 1.3 Extraction and uses of thorium and uranium-Extraction of thorium from monazite and uranium from pitch blende.	**12**	**CO1**
2	**Unit 2: Coordination Chemistry-I** 2.1 Theories of coordination compounds- Werner's theory, Effective Atomic Number rule-V.B theory- hybridization, geometry and magnetic properties of $[Ni(CN)_4]^{2-}$, $[Zn(NH_3)_4]^{2+}$,$[NiCl_4]^{2-}$, $[Fe(CN)_6]^{4-}$,$[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$, $[Fe(CN)_6]^{3-}$, $[Co(NH_3)_6]^{3+}$. Limitations of V.B theory. 2.2 Crystal field theory- splitting of metal d orbitals in octahedral and tetrahedral complexes-low spin and high spin complexes. Crystal Field Stabilization Energy (CFSE)-factors affecting Dq. Spectrochemical series. Jahn-Teller distortion-theorem-(example Cu^{2+} complex only). Explanation of magnetic properties and colour using CFT- Comparison of Valence Bond and Crystal field theories. Limitations of Crystal Field theory.	**20**	**CO2**
3	**Unit 3: Bio Inorganic Chemistry** 3.1 Toxic effect of metals-sources of metal toxicity- Hg, As, Cd, Pb, Se, Cu, Ni, Mn, Fe, Zn, K, Ba and Sb. Environmental pollution and chemical speciation of elements-Chemical speciation of Pb, Hg, As, Cd, Fe and Cr.	**10**	**CO3**

	3.2 Chelating agents used as drugs-BAL (British Anti Lewisite), EDTA, Unithiol (2,3-dimercapto-1-propane sulfonic acid), dmsa (meso-2,3-dimercapto succinic acid), D-pencillamine-desferrioxamine. Cyanide toxicity and detoxification.		
4	**Unit 4: Organometallic compounds-I** 4.1 Introduction to organometallic chemistry- Definition and Classification with appropriate examples based on nature of metal carbon bond (ionic, s, p and multicentre bonds). 4.2 Structure, bonding, properties and uses of organo Magnesium, Zinc, Lithium, Copper and Boron Compounds.	**13**	**CO4**
5	**Unit 5: Introduction to solid state chemistry** 5.1 Structures of ionic solids-sodium chloride, cesium chloride, fluorite, anti-fluorite nickel arsenide, cadmium iodide, pervoskite and zinc blende. 5.2 Structural faults in crystals. Stoichiometry defects-Schotty defects and Frenkel defects-variation of properties of crystals due to Schotty defects and Frenkel defects-thermodynamic aspect of stoichiometric defects. Non-stoichiometric defects-metal excess defects-metal deficiency defects-impurity defects-thermal defects. 5.3 Interstitial solid solutions-creating cation vacancy-creating interstitial anions-creating anion vacancy-creating interstitial cations- double substitution.	**20**	**CO5**

REFERENCE BOOKS

1. Puri B.R., Sharma, L.R., Kalia, K., Principles of Inorganic Chemistry 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Lee J. D., Concise Inorganic Chemistry, UK, Blackwell science (2006)
3. Madan, R.D., Tuli,G.D Malik.W.U Principles of Inorganic Chemistry, S.Chand, 1999.
4. Miessler, G. L. and Tarr, D. A. Inorganic Chemistry III Edition, 2004.
5. Soni P. L. Text Book of Inorganic Chemistry, S. Chand & Co., New Delhi, 2006.
6. Cotton, F. A and Wilkinson, Advanced Inorganic Chemistry. Wiley Eastern Limited, 1988.
7. B.K. Sharma, Industrial Chemistry, Geol Publications. 2002
8. R.Sarkar, General and Inorganic Chemistry Part I. Books and Allied (P) Ltd. 2006
9. R. Sarkar, General and Inorganic Chemistry Part II Books and Allied (P) Ltd. 2006.

10. Arun Bahl, Bahl, B.S. A Text Book of Organic Chemistry. S. Chand and Company Ltd. 16th Edn. 2001.
12. Morrison, R.T and Boyd. B.N. Organic Chemistry. (6th Edn.) Allyn and Bacon Ltd. 1976.
13. Shriver and Atkins. Inorganic Chemistry IV Edn. International student edn. 2006.
14. Advanced Inorganic Chemistry Vol I and II by S. P. Banerjee. Books and Allied (P) Ltd. 2003.
15. Solid state chemistry and its applications by A. R. West. 2011. Wiley student edition.
16. Organometallic Chemistry: A Unified Approach : A Unified Approach 2nd Edition R. C. Mehrotra and Singh.2014

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: CORE IX - PHYSICAL CHEMISTRY- I

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

To make the students understand how quantum chemistry is developed, appreciate the applications of Boltzmann statistics, concepts related to kinetics of reactions, conductance and its applications and fundamentals of equilibrium electrochemistry.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the basics of atomic structure (related problems) including wave particle duality
CO2	Predict the number of microstates and macro states for given set of particles and outline about Maxwell-Boltzmann statistics
CO3	Provide an insight into the kinetics aspects of chemical reactions and derive kinetic equations
CO4	Discuss the basic of ionics and applications of conductance measurements
CO5	Discuss the basics of electrode potential, cell and its applications to practical purposes

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**ATOMIC STRUCTURE** 1.1. Black body radiation, Planck's theory (Derivation not required) – equation, importance, and photoelectric effect, significance 1.2. Inadequacy of classical mechanics, Compton Effect (Derivation not required), Bohr's theory, atomic spectrum of hydrogen atom. 1.3 De-Broglie's relationship, Heisenberg's uncertainty principle and its significance. 1.4 Numerical Problems in atomic structure.	**15**	
2	**STATISTICAL THERMODYNAMICS** 2.1 Probability, microstates (permutations) and macro states (configurations), most probable distribution (dominant configuration) 2.2 Distribution applied to ideal gases- Maxwell–Boltzmann statistics, derivation and significance, partition function, translational partition function, derivation and calculations. 2.3. Derivation of thermodynamic parameters like internal energy(U), enthalpy(H), entropy(S), Helmholtz free energy(A) and Gibbs free energy(G) for monatomic gases from partition function.	**15**	
3	**CHEMICAL KINETICS -I** 3.1. Rate of a reaction, Average and instantaneous rates, rate equation, rate law, Elementary and complex reactions, order and molecularity of a reaction (related problems). Factors affecting the rate of a reaction. 3.2. Rate constants, Derivation of rate constant expression & characteristics of zero, first, second(equal and different initial concentration) and third order (equal initial concentration only) reactions . 3.3. Methods of determination of orders of reactions**:** Van't Hoff differential method, Half life method, Ostwald's isolation method. 3.4. Experimental methods of determination of rate constant of a reaction – Volumetric method and polarimetry.	**15**	

	3.5. Kinetics of complex reactions – Parallel, Consecutive and Chain reactions.		
4	**ELECTROCHEMISTRY-I** 4.1 Arrhenius theory of electrolytic dissociation and its limitations, electrolysis 4.2 Faraday's laws of electrolysis and problems 4.3 Conductance: specific, equivalent and molar conductance of strong electrolyte and calculations, measurement using Kohlrausch's bridge 4.3 Oswald dilution law, variation of specific and equivalent conductance of strong and weak electrolytes with dilution, Kohlrausch's law for infinite dilution and applications. 4.4 Debye - Huckle- Onsager theory of strong electrolytes (Derivation not required) - The conductance at high fields (Wein effect) and high frequencies (Debye-Falkenhagen effect). 4.5. Ionic mobilities: Determination of ionic mobility, abnormal ionic conductance's, -transport numbers, determination by Hittorf's method-Relationship between ionic mobilities and ionic conductance. 4.6 Application of conductance measurements: Determination of λ_∞ of strong electrolytes, Determination of K_a of weak acids, Determination of solubility product of a sparingly soluble salt and determination of ionic product of water.	**15**	
5	**ELECTROCHEMISTRY-II** **Ionic equilibrium:** 5.1 Ionic Product of Water- pH Scale- pH of weak acids and weak bases. Buffer solutions-mechanism of buffer action- derivation of Henderson equation and its applications. Buffer capacity, buffer range, application of buffer solution for the biochemical processes in the human body. **Equilibrium electrochemistry:** 5.2 Cells: Electrolytic & Galvanic cells – Reversible and irreversible cells. 5.3 Coulomb's law-electric field strength-electric potential -Outer potential, surface potential and inner potential- Electrochemical	**15**	

	potential, Potential difference across electrode-electrolyte interface- Absolute electrode potential - Conventional representation of electrochemical cells. 5.4 Electromotive force of a cell and its measurement using Pogondorf"s compensation principle. Relative electrode potential, Standard hydrogen electrode - Reference electrodes- Standard electrode potentials 5.5 Electrochemical series and its applications- Calculation of thermodynamic parameters of Cell reactions (ΔG, ΔH, ΔS and K). 5.6 EMF dependence on concentration- Nernst equation – Derivation and problems. Types of reversible electrodes – Gas electrode, metal/metal ion electrode- Amalgam electrode – metal- metal insoluble salt and its anion electrode and Redox electrodes-ion selective electrodes(glass electrode) Electrode reactions		

REFERENCE BOOKS:

1. Principles of Physical Chemistry, Puri, Sharma, Pathania
2. Physical Chemistry: Robert G. Mortimer
3. Advanced Physical Chemistry Oxford Press. W. Atkins 1990
4. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi
5. A Text book of Physical Chemistry, A S Negi, S C Anand
6. Physical Chemistry, J. Moore- 4th edn
7. Elements of Physical Chemistry, Samuel Glasstone
8. A text book of physical chemistry: KL Kapoor (Volume 5-Chemical Kinetics)
9. Principals of physical chemistry,S H Maron and C F Prutton (Electrochemistry)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

COURSE TITLE: ELECTIVE I - ANALYTICAL CHEMISTRY

Course Code :		**Credits**	**: 05**
L:T:P:S	**: 6:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

This course is offered for students to have exposure to the Laboratory safety practices, Instrumental techniques. The student gets clear idea about the principle and Instrumentation of various techniques which are most useful in chemical Industries.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1.	To enumerate on Laboratory hygiene and safety and to tabulate the statistical analysis of data. [K1]
CO 2	To quantify the ions gravimetrically and assess the differential weight with respect to temperature thermogravimetrically. [K3]
CO 3.	To identify different currents, and distinguish metal ions by half wave potential from polarogram. To determine the end point of the titrations by amperometry. To interpret the presence of racemic mixture by polarimeter. [K3]
CO 4.	To analyse the mixture using column, paper, HPLC, and gas chromatography. [K4]
CO 5.	To deduce and quantify the presence of metal ions by flame emission and atomic absorption spectroscopy. [K3]

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**LABORATORY HYGIENE, SAFETY AND ERRORS IN CHEMICAL ANALYSIS** 1.1 Laboratory Hygiene and safety 1.1.1 Storage and handling of chemicals 1.1.2 Waste disposal and fume disposal 1.1.3 General precautions for avoiding accidents 1.1.4 First aid techniques 1.1.5 Hazards in laboratory 1.1.6 Chemical poisoning and Universal antidotes 1.1.7 Laboratory safety measures 1.2 ERRORS IN CHEMICAL ANALYSIS 1.2.1 Types of errors 1.2.2 Accuracy and Precision, Absolute and relative uncertainty, propagation of uncertainty. 1.2.3 Gaussian distribution, arithmetic mean, median, range, mean deviation, standard deviation, confidence intervals related problems. 1.2.4 Statistical Analysis of data (the F test, the t test, Q test for rejection of data, paired t-test,least squares method). 1.2.5 Theory of significant figures	**15**	**CO1**
2	**GRAVIMETRIC ANALYSIS AND THERMOANALYTICAL METHODS** 2.1.1 GRAVIMETRIC ANALYSIS Methods of obtaining the precipitate -Conditions for precipitation-Choice of precipitants -Advantages and disadvantages of using organic precipitants-Types of organic precipitants-Specific and selective precipitants 2.1.2 Sequestering agents- Co-precipitation (surface adsorption, mixed-crystal formation, occlusion, and mechanical entrapment, co precipitation errors) 2.1.3 Post precipitation-Effect of digestion-Precipitation from Homogeneous medium-Washing- Drying and Ignition of precipitates-calculations in gravimetric methods-use of gravimetric factor.	**15**	**CO2**

	2.2 THERMOANALYTICAL METHODS 2.2.1 Thermogravimetric Analysis-Principle, discussion of various components with block diagram- Discussion of thermograms- Silver nitrate, Copper Sulphate pentahydrate, Calcium oxalate mono hydrate 2.2.2 Differential Thermal analysis-Principles, discussion of various components with block diagram- Discussion of thermograms- Calcium acetate mono hydrate, Calcium oxalate mono hydrate. Factors affecting TGA and DTA curves 2.2.3 Thermometric titrations and applications- Mixture of Ca^{2+}, Mg^{2+}ions Vs EDTA		
3	**Polarography and Polarimetry** 3.1 Principle- over potential-concentration polarization-dropping mercury electrode (DME)-advantages and disadvantages- applications 3.2 Migration, convection and diffusion currents- Ilkovic equation (derivation not required) and its significance-Half wave potential ($E_{1/2}$) – significance. 3.3 Experimental assembly-Half wave potential for electrodes-Dropping mercury electrodes, reference electrodes-circuit. Solutions-oxygen wave; factors affecting diffusion current. Polarography as an analytical tool in quantitative and qualitative analysis. 3.4 Amperometry-basic principles, types of titration curves and uses. 3.5 Polarimetry-principle-instrumentation-comparison of strength of acids-estimation of glucose.	**15**	**CO3**
4	**Basic Chromatographic Techniques** 4.1 Paper Chromatography –principles-experimental techniques and applications 4.2 Column Chromatography –principles-experimental techniques and applications 4.3 Thin layer Chromatography - principles-experimental techniques and applications 4.4 Gas chromatography- principles-experimental techniques-instrumentation and applications 4.5 High pressure liquid chromatography- principles-experimental techniques-instrumentation and applications	**15**	**CO4**
5	**Atomic Spectrometric Methods**	**15**	**CO5**

	5.1 Flame emission spectroscopy. Introduction, Principle, Flame photometer, Nebulizer- burner system, Pressure regulators, optical system. Evaluation methods- Interferences-Applications **5.2 Atomic Absorption spectroscopy** Instrumentation, Hollow cathode lamp, Qualitative analysis- Application – Limitation.		

TEXT & REFERENCE BOOKS

1. S.M. Khopkar, Analytical Chemistry- Narosa Publishing House. 2002.
2. R. Gopalan, P. S. Subramanian, K. Rengarajan. Elements of Analytical Chemistry- Sultan Chand, 2009.
3. D. A. Skoog, 1985, Principles of Instrumental Methods of Analysis, III Edn. Saunders College Pubs.
4. Vogel's hand book of quantitative inorganic analysis- Longman, 1964.
5. D. A. Skoog and D. M. West, 1982 Fundamental of Analytical Chemistry, IV Edn. Old Reinhord& Winston Pubs.
6. B.K. Sharma, Instrumental methods of chemical analysis-Goel Publications. 2004.
7. Instrumental methods of analysis, H.H.Willard, L.I. Merrit Jr and J.A.Dean. Affiliated East West Press 1974.
8. Instrumental Methods Of Chemical Analysis by Dr.G.R.Chatwal, Sham Anand
9. Instrumental Approach to Chemical Analysis, by A.K.Srivatsava & P.C. Jain

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

COURSE TITLE: ELECTIVE I - PHARMACEUTICAL CHEMISTRY

Course Code :	**Credits : 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

Units	Learning objectives
01	To understand the common diseases and the cure To know the terms of pharmacology
02	To understand the mechanism of drug action
03	To acquire knowledge about chemotherapy and the antibiotics
04	To understand the drugs used for diabetes, hypertension, cholesterolemia
05	To acquire knowledge about various health promoting drugs

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	2	2	2	2	3	3	2	3	2
CO4	3	3	3	3	3	3	2	3	3	3	2	3	2
CO5	3	3	3	3	3	3	2	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No.	CONTENTS OF THE MODULE	Hrs	COs
1	**UNIT 1: INTRODUCTION** 1.1 Common diseases - Infective diseases - insect-borne, air-borne and water-bome hereditary diseases - Terminology – drug pharmacology, pharmacognesy, pharmacodynamics, pharmacokinetics, antimetabolites. 1.2 Absorption of drugs - routes of administration of drugs, factors affecting absorption. 1.3 Assay of drugs - chemical, biological immunological assays, LD_{50} and ED_{50} therapeutic index, drug dosage.	**15**	**CO1,**
2	**UNIT 2: DRUGS** 2.1 Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants - tulsi, neem, keezhanelli - their importance. 2.2 Classification of drugs-biological chemical - Mechanism of drug action - Action at cellular and extra cellular sites. 2.3 Drug receptors and biological responses - Metabolism of drugs through oxidation, reduction hydrolysis and conjugate processes, factors affecting metabolism.	**15**	**CO2,**
3	**UNIT 3: CHEMOTHERAPY** 3.1 Designation of drugs based on physiological action: Definition and two examples each of Anaesthetics – General, IV and local. 3.2 Analgesics - Nartcotic and synthetic- Antipyretics and anti-inflammatory agents. 3.3 Antibiotics – penicillin, Streptomycin, chloramphenicol, tetracycline – Antivirals. 3.4 AIDS - symptoms prevention, treatment - Cancer and neoplastic agents.	**15**	**CO3,**
4	**UNIT 4: COMMON BODY ELMENTS** 4.1 Diabetes - Causes, hyper and hypoglycemic drugs - Blood pressure - Sistolie & Diastolic	**15**	**CO4,**

	4.2 Hypertensive drugs - Cardiovascular drugs – antiarrhythmic, antianginals, vasodilators - CNS depressants and stimulants - Psychedelic drugs, hypnotics, sedatives (barbiturates, LSD) – 4.3 Lipid profile - HDL, LDL cholesterol lipid lowering drugs.		
5	**UNIT 5: HEALTH PROMOTING DRUGS** 5.1 Nutracenticals - vitamins A, B, C, D, E and K micronutrients Na, K, Ca, Cu, Zn, I - Medically important inorganic compounds of Al, P, As, Hg, Fe - Li examples each their role and applications - Organic Pharmaceutical acids; Agents for kidney function (Aminohippuric acid). 5.2 Agents for liver function (Sulfo bromophthalein). Agents for pituitary function (metyrapone). 5.3 Organic pharmaceutical bases - antioxidents, treatment of ulcer and skin diseases.	**15**	**CO5**

Text Book

Jayashree Ghosts, Pharmaceutical Chemistry, S. Chand and Company Ltd., 2006, New Delhi

Books for Reference

1) Lakshmi S., Pharmaceutical chemistry, S. Chand & Sons, 1995, New Delhi
2) Ashuttosh Kar, Medicinal chemistry. Wiley Eastern Ltd . 1993. New Delhi.
3) Divid William & Thomas Lemke, Foyes principles of medicinal chemistry, 5th edition, 2005. BI publishers
4) Romas Nogrady, Medicinal Chemistry, II edition 2004, oxford university, press

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: CORE X - ORGANIC CHEMISTRY II

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

At the completion of this course, students will be able to draw the structure and derive at the configuration of simple carbohydrates like glucose and fructose and understand the structural features of disaccharides. They will be able to distinguish between peptides, their structure and function. They can able to interpret and classify the type of nucleic acids, importance of vitamins and application of lipids. Will also enable them to understand and appreciate the importance of alkaloids and terpenoids.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	They can define & classify carbohydrates They can differentiate between configuration & conformation .They can draw the fischer, newmann conformation for simple molecules like D-glucose & can draw the structure of polysaccrides like starch & cellulose. They can compare / differentiate the reactivity of glucose & fructose. They can able to interconvert various forms of sugars. They can predict the products/ propose the mechanisms. They can determine the ring size- pyranose & furanose form.
CO2	They can classify reducing & non-reducing sugars. They can able to draw the structure of starch & cellulose.They can determine the structure of sucrose, maltose & lactose by chemical degradation.
CO3	They can able to define amino acids, proteins & polypeptides. They can able to classify proteins & peptides. They can draw and determine the structure of proteins by end group analysis**.** They can understand the biological importance proteins & amino acids.
CO4	They can draw the structure of base like adenine & guanine. They can able to differentiate nucleotides & nucleoside**.** They can explain the structure of DNA & RNA. They can define, steroids, fatty acids & classify fats**.** They can draw the structure of vitamin A & Steroids like cholesterol**.** They can understand the biological importance of DNA & RNA.
CO5	They can draw the simple structure of terpenoids like citral , geraniol. They can able to explain the synthesis of important terpenoids like piperine, papaverine.They can determine the structure of terpenoids by chemical degradation method.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	2	2	2	2	3	3	2	3	2
CO4	3	3	3	3	3	3	2	3	3	3	2	3	2
CO5	3	3	3	3	3	3	2	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1: Carbohydrates – I** 1.1 Definition and Classification 1.2 Fischer, Haworth and Conformational structures – Configuration – D, L-Ascending of carbon chain in sugars – Kiliani-Fischer synthesis -Descending of carbon chain in sugars- Ruff's synthesis. 1.3 Interconversion of sugars - Glucose to Fructose and Fructose to Glucose. 1.4 Reactions - Acetylation, Methylation, bisulphite addition, cyanohydrin, Oxime formation – Mechanism of Osazone formation, Action of con-H_2SO_4 and dil.alkali.acetal and hemiacetal . 1.5 Oxidation and Reduction: with Bromine water, Con .HNO_3, HIO_4, Benedict, Fehling's and Tollen's reagents, with HI, H_2/Ni and Na-Hg - Mutarotation. 1.6 Structural elucidation of Glucose and Fructose-Evidences for open chain and ring structure. Determination of ring size – Pyranose & Furanose forms - differentiation between epimers and anomers**.**	**15**	**CO1**

2	**Carbohydrates – II** 2.1 Disaccharides –Linkage, Classification, - Reducing and non-reducing sugars. 2.2 Source, Constitution and Haworth projection - Structural elucidation of Sucrose, maltose and lactose. 2.3 Polysaccharides -structure of starch, cellulose and cellobiose (Elucidation of structure is not required)- Hydrolysis products. 2.4 Derivatives of cellulose- Preparation, structure and uses of cellulose nitrates, cellulose acetates, cellulose xanthates and ethyl cellulose.	**15**	**CO2**
3	**UNIT 3: Amino Acids, Polypeptides and Proteins** 3.1 Amino acids - Definition, classification, Zwitter ions, isoelectric point. Preparation of glycine , alanine and phenyl alanine –Strecker's synthesis, Gabriel Phthalimide synthesis, chemical properties – Biuret, Millon's test- Xanthoproteic and Ninhydrin Test. 3.2 Peptides and Proteins - Occurrence, classification (based Structural and chemical composition), Partial and complete hydrolysis , denaturation and annealing. 3.3 Primary and secondary structure of proteins -End group analysis- N-terminal analysis - Enzymatic method, Dansyl method, Sanger and Edmand method – C terminal analysis - enzymatic method, hydrazinolysis , hydanatoin formation method - Tertiary and Quaternary Structure of Proteins(elementary idea only).	**15**	**CO3**
4	**UNIT 4 : Nucleic Acids, Vitamins and Lipids** 4.1 Nucleic acids- Components of DNA and RNA –Structure of bases - adenine, guanine, Thymine, Cytosine and Uracil. 4.2 Nucleosides and nucleotides (nomenclature)- Structure of polynucleotide- Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation – genomic sequence. (Basic idea only)	**15**	**CO4**

	4.3 Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. 4.4 Steroids – structure of simple steroids –Cholesterol 4.5 Vitamins – Classification – based on structure and function-ological importance of Vitamins, Structures of Vitamin A and itamin D. Structural elucidation of Vitamin C.		
5	**UNIT 5: Alkaloids and Terpenoids** 5.1 Alkaloids: Definition, Classification, Extraction (elementarytreatment).General methods for determining structure -Chemical methods-uses. 5.2 Structural elucidation and synthesis of Conine, Piperine , Nicotine ,Papavarine. 5.3 Terpenes and Terpenoids: Classification, Isoprene and special isoprene rules, Isolation, General methods of structural determination-Chemical methods. 5.4 Structural elucidation and synthesis of Citral, Geraniol, α – Terpineol.	**15**	**CO5**

REFERENCES & TEXT BOOKS

1. Finar I.L., Organic Chemistry, Vol. 1& 2, 6th edition, Addison Wesley Longman Ltd. England(1996)
2. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
3. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., NewDelhi (1997)
4. Pine S.H., Organic Chemistry, 4th edition, Mc-Graw-Hill International Book Company New Delhi(1986)
5. Seyhan N. Ege, Organic Chemistry, 5th edition , Houghton Mifflin Co., New York, (2004)
6. P.S.Kalsi, Stereochemistry, Conformation Analysis and Mechanism, 2nd Edition, Wiley Eastern Limited, Chennai (1993)
7. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).

8. Janice Gorzynski Smith., Organic Chemistry, 5th Edition, New Delhi, Mc-Graw-Hill International Book Company, New Delhi (2010)
9. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)
10. Richard O.C. Norman., James M. Coxon., Principles of Organic Synthesis,3rd Edition (1993)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: CORE XI - INORGANIC CHEMISTRY II

Course Code :		**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Learning objective:

The objective of the course is to equip the students to Application of coordination compounds Qualitative analysis detection of metal ions and quantitatively analysis and types of organo metallic compounds on the basis of the nature of metal-carbon bond and non-ionising-general properties of ionizing solvent: electrical conductance, dipole moment, dielectric constant, viscosity, associated molecules, Fundamental particles of the nucleus-classification of fundamental particles-nucleon terminology of nuclides and Artificial radioactivity- Uses of radio isotopes-tracer technique, structural study-study of reaction mechanism

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Qualitative analysis very useful to identified various oxidation state of the metal. 18 electron rule to understanding the stability of various carbonyl complex
CO2	Therapeutic chelating agents are used as antidotes for heavy metal poisoning. EDTA and other complexing agents have been used to speed the elimination of harmful radioactive and other toxic elements from the body. (e.g. Pb2+). In these cases a soluble metal chelate is formed.
CO3	Chelating agents can be used as Synthetic detergents such as tripolyphosphate. The chelating agent sequesters hard-water cations, rendering them incapable of interfering with the surfactant. Gravimetric Analysis : Here chelating ligands are often used to form insoluble complexes e.g. Ni(DMG)2 and Al(oxine)3. So we can estimate amount of ion present in unknown solution
CO4	Rationalize the synthesis, structure, bonding, properties and reactivity of both main group and transition metal organized Industrially important catalytic processes through the application of organometallic principles. Work to a professional level of skills in a chemical synthesis laboratory demonstrating effective laboratory safety and etiquette especially in the areas of handling of air sensitive reagents, chromatographic techniques and spectroscopic characterization

CO5	Clathrate compounds used as medical applications such as in magnetic resonance imaging. Used to study the photo-behaviour of organic and inorganic molecules by introducing them as probes (guests) into clathrate cages. Resolution of racemic mixtures. Zeolites can remove atmospheric pollutants, ozone-depleting CFC's and harmful organics from water.
CO6	understated and calculate the mass defect for a nuclear reaction and calculate nuclear binding energy Define the age of an object (radiochemical dating) Differentiated Artificial radioactivity and induced radioactivity, how energy produced from different type of reactor
CO7	Recognize and uses of proton, neutron, electron, positrons, alpha particles, beta particles and gamma particles.Comparing the penetrating power of alpha particles, beta particles and gamma particles.Qualitatively interpret a decay series. Recognize a band stability plot and be able to predict the type of decay that a nucleus will undergo based on its composition relative to the band of stability.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
CO2	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**3**
CO5	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**2**
CO6	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO7	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE	Hr	COS
1	**COORDINATION CHEMISTRY-II** Application of coordination compounds in analytical chemistry: Qualitative analysis- detection of metal ions; Cu^{2+} in presence of Cd^{2+}, Ni^{2+} in the presence of Co^{2+}, Fe^{3+} and Al^{3+} using oxine; detection of chloride ions. Quantitative analysis-Inner metallic complexes- I order inner complexes- II order inner complexes-Application of I order inner metallic complexes in gravimetric determination of metal ions-Separation and estimation of metal ions by ion-exchange. Complexometric titrations-definition-chelon, complexing agents, complexometric titration and examples. Complex formation reactions and selection of complexometric titrants-methods employed in complexometric titrations-direct titration, back titration, replacement of substitution titration, indirect titration, estimation of multiple cations in a mixture. Application of complexometric titration-estimation of total hardness of water using EDTA, Metal carbonyls –mono and polynuclear -Ni, Fe, Cr, Co and Mn- structures and bonding. EAN rule (18 electron rule) molecular orbital approach- -explanation of 18 electron rule in metal carbonyl and formation of some carbonyls on the basis of this rule. Ex. $Ni(CO)_4$, $Cr(CO)_6$, $Fe(CO)_5$, $Mn_2(CO)_{10}$, $Co_2(CO)_8$, $Fe_2(CO)_9$.	**20**	**CO1,CO2 and CO3**
2	**ORGANOMETALLIC COMPOUNDS-II** Sigma base -pi acid ligands, pi base-pi acid ligands- types of organo metallic compounds on the basis of the nature of metal-carbon bond. Organo metallic compounds of alkenes, alkynes and cyclopenta diene. Ferrocence-Preparation, properties, structure and bonding.	**10**	**CO4**
3	**CLATHRATE COMPOUNDS NON-AQUEOUS SOLVENTS** Clathrate compounds– Clathrates of noble gases, phenol and quinol-its uses. Silicones - synthesis, properties and uses. Non Aqueous Solvents: Classification of solvents-*Cady-Esley* rule-protic and aprotic –acidic, basic, amphiprotic-ionising, non-ionising-general properties of ionizing solvent: electrical conductance, dipole moment, dielectric constant, viscosity,	**15**	**CO5**

	associated molecules. Chemistry of liquid NH_3: acid-base reactions-amphoteric behavior-formation of ammoniates-ammonialysis-complex formation- redox reaction- precipitates formation-extreme dissociation of weak acid-solubility of substances in liquid NH_3-advantages and disadvantages of liquid NH_3 as solvent. Chemistry of SO_2 as solvent: acid-base reactions-amphoteric behavior-solvation reaction and formation of solvents-solvolysis-complex formation reaction- redox reaction- precipitate formation-organic reactions in liquid SO_2.		
4	**NUCLEAR CHEMISTRY-I** 4.1 Fundamental particles of the nucleus-classification of fundamental particles-nucleon terminology of nuclides- isotopes-isobars-isotones-mirror nuclei. Nuclear radius, nuclear volume-nuclear mass and nuclear forces operating between the nucleons. Nuclear stability-N/P ratio, curves, stability belts. 4.2 Nuclear binding energy, Mass defect, simple calculations involving mass defect binding energy per nucleon, and packing fraction. Magic numbers-liquid drop model, shell model.	**15**	**CO6**
5	**NUCLEAR CHEMISTRY-II** 5.1 Natural radioactivity - radioactive series including neptunium series - group displacement law. Applications: employing gamma radiations-food products-testing of metal castings-pest control by irradiation-employing isotopes: tracer technique-structural study ($S_2O_3^{2-}$ only)-study of reaction mechanism-study of photosynthesis-in medicine. 5.2 Artificial radioactivity- -tracer technique, structural study-study of reaction mechanism-study of equilibria-study of photosynthesis-radio isotopes in medicine-radio carbon dating. Nuclear fission- mechanism of nuclear fission. Nuclear reactors-the design and construction of the nuclear reactor-safety measure and location of the nuclear reactor-nuclear fusion-characteristics of nuclear fusion.	**15**	**CO7**

REFERENCE BOOKS

1. Puri B.R., Sharma, L.R., Kalia, K., Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Lee J. D., Concise Inorganic Chemistry, UK, Blackwell science (2006)
3. Madan, R.D., Tuli,G.D Malik.W.U Principles of Inorganic Chemistry, S. Chand, 1999.
4. Miessler, G. L. and Tarr, D. A. Inorganic Chemistry III Edition, 2004.
5. Soni P. L. Text Book of Inorganic Chemistry, S. Chand & Co., New Delhi, 2006.
6. Cotton and Wilkinson. Advanced Inorganic Chemistry. Wiley Eastern Limited. 1988.
7. B.K. Sharma. -Industrial Chemistry Geol Publications. 2002.
8. Sarkar. R, General and Inorganic Chemistry Part I Books and Allied (P) Ltd.2006.
9. Sarkar .R, General and Inorganic Chemistry Part II Books and Allied (P) Ltd.2006.
10. R. D. Madan. Modern Inorganic Chemistry. Sultan Chand and Company Ltd. 2006.
11. Advanced Inorganic Chemistry Vol I and II by S. P. Banerjee. Books and Allied (P) Ltd. 2003.
12. Advanced Inorganic Chemistry Vol I and II by Satya Prakash, G. D. Tuli, S. K. Basu and R.D Madan S. Chand & Co., New Delhi, Reprint. 2012.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: CORE XII - PHYSICAL CHEMISTRY II

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Learning objective:

To make the students apply the principles involved in the spectroscopy of gases, various theories of reaction rates, concepts of catalysis and adsorption, set up various electrochemical cells and determine their applications, set foundations for group theory, elementary photochemistry and quantum chemistry

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	compare the energy gap between translational, rotational, vibrational and electronic energy levels
CO2	determine bond length, dissociation energy, force constant and zero point energy and so on of gaseous molecules using the principles of spectroscopy.
CO3	Quantitatively calculate the effect of temperature on the rate of a reaction using collision theory and ARRT which helps him to plan the chemical reaction.
CO4	compare the catalytic activity of conventional catalyst and enzyme catalyst and make use of its specificity and sensitivity to temperature and pH to plan the chemical reaction.
CO5	Students could set up different chemical and concentration cells to generate electricity and also explain the working of pace maker cells.
CO6	Determine the concentration of an unknown solution, solubility product and activity coefficient etc. with the help of the potentiometer.
CO7	Use the concept of overvoltage for the selection of suitable electrodes in the construction of battery or electrolysis**.** They will be able to control the corrosion using thermodynamic and kinetic concepts and also utilizing passivation.
CO8	Explain the foundation for the advanced group theory which finds wider applications in fields such as quantum chemistry, spectroscopy etc. They can discuss and explain the various photochemical and photo physical processes
CO9	Apply Schrodinger wave equation to quantum mechanical systems such as 1D, 2D, 3D and rigid rotor to deduce the expression for the energy which he can use in molecular spectroscopy.
CO10	Can set up Schrodinger equation for hydrogen atom and identify the radial and angular probability distribution functions to visualize and grasp the concept of various orbitals and their shapes

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	1	2	1	3	3	2	3	3	3
CO2	3	3	3	1	2	2	1	3	3	3	3	3	3
CO3	3	3	3	1	1	2	2	3	3	2	3	2	2
CO4	3	3	3	1	2	2	3	3	3	2	3	3	3
CO5	3	3	3	3	1	2	2	3	3	3	3	2	3
CO6	3	3	3	2	1	2	1	3	3	2	2	2	3
CO7	3	3	3	3	2	3	3	3	3	3	2	2	2
CO8	3	2	3	3	1	1	1	3	3	2	2	3	3
CO9	3	3	3	1	1	1	1	2	3	2	2	3	2
CO10	3	3	3	3	2	2	1	3	3	3	3	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: SPECTROSCOPY** 1.1 **Interaction of radiation with matter**: Electromagnetic spectrum, quantisation of energy, Rotational, vibrational and Electronic energy levels- Difference between spectra of atoms and molecules-Absorption and emission spectra. 1.2 **Boltzmann distribution** (formula only): Relative population of translational, rotational, vibration and electronic energy levels at different temperatures. 1.3 **Microwave spectroscopy**: Rotational spectra of diatomic molecules, rigid rotator, selection rule for rotational transition, Frequency of spectral lines, calculation of inter-nuclear distance in diatomic molecules. Isotope effect -Instrumentation. 1.4 **Infrared spectroscopy**: Vibrations of diatomic molecules, Harmonic and anharmonic oscillators, zero point energy, selection rule	**15**	**CO1, CO2**

	for vibrational transition, determination of zero point energy, v_{max} of dissociation, force constant- Fundamental band, Overtones and hot band (simple treatment-only concepts). isotope effect. 1.5 Vibration-rotation spectra of diatomic molecules-PQR branches 1.6 **Raman spectroscopy**: Rayleigh scattering and Raman scattering-Explanation based on quantum theory only, Stokes and antistokes lines in Raman spectra,Raman frequency, condition for molecule to be Raman active - Comparison of Raman and IR spectra-Raman and IR spectroscopy of CO_2 and N_2O as examples-Rule of mutual exclusion principle. Instrumentation.		
2	**Unit 2: CHEMICAL KINETICS –II Catalysis & adsorption** 2.1 Effect of temperature on reaction rates – concept of activation energy, energy barrier- Arrhenius equation. 2.2 Theories of reaction rates – Collision theory –Failures of collision theory and correction factors- Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate for a bimolecular reaction (based on thermodynamic concept) – significance of entropy, enthalpy and free energy of activation. Comparison of Arrhenius theory, collision theory and ARRT. 2.3 Catalysis- Homogeneous and heterogeneous catalysis-Enzyme catalysis-Effect of temperature and pH on enzyme catalyzed reactions. Derivation of Michaels –Menton equation –Adsorption - Freundlich adsoption - Langmuir adsorption –B.E.T theory of multilayer adsorption-B.E.T Equation (no derivation)	**15**	**CO3, CO4**
3	**Unit 3: ELECTRO CHEMISTRY-III** 3.1 Electrochemical cells: Types, Chemical cells with and without transport-Concentration cells, membrane potential, pace maker cells. 3.2 Concentration cells with and without transport, Liquid junction potential. 3.3 Application of EMF measurements: Determination of Valency of ion, solubility product (concentration cell and chemical cell method) and activity co-efficient of an electrolyte.	**15**	**CO5, CO6, CO7**

	3.4 Determination of pH using Hydrogen, quinhydrone and glass electrodes and determination of pKa of weak acids by potentiometric method. 3.5 Potentiometric titrations: Strong Acid vs strong base, Mixture of strong acid and weak acid Vs strong base, Polybasic acid with strong base, Redox titrations, Precipitation titrations, Mixture of halides Vs $AgNO_3$. 3.6 Acid-Storage batteries, Fuel Cells, Decomposition potential, Overvoltage. 3.7 Corrosion: General and electrochemical theory of corrosion, prevention of corrosion, passivation.		
4	**Unit 4: GROUP THEORY AND PHOTOCHEMISTY** 4.1 Symmetry operations, Symmetry elements- axis of symmetry, plane of symmetry, Centre of symmetry, improper axis of symmetry and identity element as applicable to H_2O, NH_3, BF_3 and CH_4 molecules. 4.2 Illustration of mathematical rules for the group using symmetry operations of H_2O molecule-Construction of group multiplication table for C_2v and C_3v point groups. 4.3 Laws of photo chemistry: Beer-Lambert, Grothus–Draper and Stark – Einstein laws. 4.4 Quantum efficiency. Photo chemical reactions – rate law – comparison between thermal and photochemical reactions. 4.4 Photo physical processes, Fluorescence and Phosphorescence-photosensitization-Chemiluminescence.	**15**	**CO8**
5	**Unit 5: QUANTUM MECHANICS FOR BEGINNERS** 5.1 Postulates of quantum mechanics –equation- normalized, orthogonal and orthonormal Functions- quantum mechanical operations. 5.2 Particles in a box with infinite potential barrier (1D, 2D, 3D) 5.3 Rigid rotor in 3D (no derivation) 5.4 1D- Simple harmonic oscillator (no derivation) 5.5 Hydrogen atom (no derivation), radial and angular probability distribution. 5.6 Concept of orbitals.	**15**	**CO9, CO10**

REFERENCE BOOKS:

1. Principles Of Physical Chemistry , Puri, Sharma Pathania
2. Physical Chemistry, Gilbert W. Castellan, 3rd edition
3. Physical Chemistry: Robert G. Mortimer
4. W. Atkins Advanced Physical Chemistry Oxford Press. 1990
5. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi
6. A text book of physical chemistry: KL Kapoor (Volume 4-quantum, 5- kinetics)
7. Principals of physical chemistry,S H Maron and C F Prutton (Electro chemistry)
8. R.K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 1992.
9. Quantum Chemistry, Second Edition, Donald A. McQuarrie
10. Group theory an its applications, Salahuddin Kunju, G Krishnan
11. A Text book of Physical Chemistry, A S Negi, S C Anand
12. Physical Chemistry, J. Moore- 4^{th} edn
13. Molecular Spectroscopy, Banwell
14. Text book of Physical Chemistry, Samuel Glasstone

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: ELECTIVE II - APPLIED CHEMISTRY

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OBJECTIVES:

This course aims to explain the crucial role of polymers, pharmaceuticals and dairy products which are popular in different dominions of science, technologies ,industries and integral part in vital life processes.. In addition, currently budding research applications of nano chemistry will also be discussed in detail.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define the pragmatic impacts of polymer in human daily life.
CO2	Quote the chemical changes which are taking place in a polymer like degradation with live examples.
CO3	Explain the importance of Glass transition temperature (Tg) as a tool to modify the physical properties of drugs and polymer molecules.
CO4	Solve the chemical quality related issues of dairy industry.
CO5	Apply the knowledge on physico-chemical properties and composition of milk to distribute them into useful dairy products.
CO6	Summarise the concepts of forensic science for its pivotal role in legal system and related issues
CO7	Explain the major facts of investigations as well as evidence collection and preservation techniques.
CO8	Analyse a crime scene and they will be in a position to assess and interpret the evidences based on chemical and instrumental analysis.
CO9	Predict the chemical formulation of drugs which are chronically used.
CO10	Compare the size of objects of nano and micro levels with bulk entities.
CO11	Explain the importance of surface area and how it helps in increasing the reaction rate and wide field applications are formulated based on nano particles.
CO12	Classify the various medicinal application of nano particles involved in drug delivery, therapy technique and diagnosis.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3
CO7	3	3	3	3	3	3	3	3	3	3	3	3	3
CO8	3	3	3	3	3	3	3	3	3	3	3	3	3
CO9	3	3	2	2	3	3	3	3	3	3	3	3	3
CO10	3	3	3	3	3	3	3	3	3	3	3	3	3
CO11	3	3	3	3	3	3	3	3	3	3	3	3	3
CO12	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1: Polymer Chemistry** 1.1 Introduction to polymers- Tacticity- Properties: glass transition temperature (T_g) – Definition – factors affecting T_g – relationships between T_g and molecular weight and melting point. Importance of T_g. 1.2 Molecular weight of polymers: Number average, weight average, viscosity average molecular weights, and degree of polymerization. 1.3 Reactions: hydrolysis – hydrogenation – addition – substitutions – cross linking vulcanization and cyclisation reactions. 1.4 Basic idea on thermal, photo and oxidative degradations of polymers. 1.5 General methods of preparation, properties and uses of the following Polymers: polycarbonates, polymethylmethacrylate, polyethylene, polyurethanes, polyesters, polyamides (Kevlar), rubber-styrene and neoprene rubbers.	**15**	**CO1, CO2 and CO3**

2	UNIT 2: Dairy Chemistry 2.1 composition of milk, Flavour and aroma of milk, physical properties of milk 2.2 Effect of heat on milk, Pasteurisation, Homogenisation 2.3 Milk products, Cream Butter, Ice cream, Milk powder.	**15**	**CO4 and CO5**
3	UNIT 3: Forensic chemistry 3.1 Definition, History, Development and Scope of Forensic Science. 3.2 General methods of chemical analysis for alcohol, Classification of poisons. 3.3 Identification and detection of biological fluids (Blood, Semen, Saliva and Urine) and their Medico-logical importance. 3.4 Modern Developments and their concepts (Narco analysis, Brain mapping, fingerprinting, DNA Profiling, voice identification, Cyber crime, Forensic Odontology and Bitemarks). 3.5 procedure of taking fingerprints; identification of pattern types, developing latent fingerprints (Powder Method), spot test for blood identification.	**15**	**CO6, CO7 and CO8**
4	UNIT 4: Pharmaceutical chemistry 4.1 Designation of drugs based on physiological action; Definition and two examples each Anaesthetics – General, intravenous and local – Analgesics – Narcotic and synthetic – Antipyretics and Anti Inflammatory Agents – antibiotics – Pencillin, Chloramphenicol, – AIDS – symptoms prevention, treatment – Cancer and neoplastic agents. 4.2 Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – Systolic & Diastolic Hypertensive drugs – Cardiovascular drugs – anti-arrhythmic, anti-anginals, vasodilators	**15**	**CO9**
5	UNIT 5: Nano Chemistry 5.1 Nanochemistry - definition, Classification of nano materials based on the size, shape, surface morphology. chemical methods of preparation of nano particles (Gold, Silver, Cadmium, Zinc- Sulphides, Selenides), XRD, characterization, Surface area (BET equation), SEM, TEM (Elementary idea) 5.2 Nano particles - Properties of Nano particles, General method of Preparation-sol gel technique. 5.3 Application of Nanoparticles in various fields- Basic idea.	**15**	**CO10, C011 & CO12**

TEXT BOOKS AND REFERENCES

1. Gowariker V.R., Viswanathan N.V. and Jayader Sreedhar, Polymer Science, Wiley Eastern Ltd., New Delhi, 1978
2. Sharma, B.K., Polymer Chemistry, Goel Publishing House, Meerut, 1989.
3. Arora M.G., Singh and Yadav M.S., Polymer Chemistry, 2nd Revised edition, Anmol Publications Private Ltd., New Delhi, 1989.
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ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: ELECTIVE II - INDUSTRIAL CHEMISTRY

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Units	Learning objectives
01	To understand the requirements to start an industry – different fuels used and the industrial catalyst used. K3
02	To know about different petrochemical industries thoroughly. K3
03	To understand the manufacture of fertilizers and speciality chemicals. K3
04	To acquire knowledge about oils, soaps, detergents, sugar industry, leather and pesticide industries. K3
05	To understand the important process of metallurgy extraction of metals and environmental problems caused by chemical industries K4

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MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	2	1	2	2	3	2	3	2	3
CO2	3	3	3	2	2	1	2	2	3	2	3	2	3
CO3	3	3	3	2	3	2	2	2	3	3	3	3	3
CO4	3	3	3	2	3	2	3	3	3	3	3	3	2
CO5	3	3	3	2	3	2	3	3	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No.	CONTENTS OF THE MODULE	Hrs	COs
1	**UNIT 1: INDUSTRIAL REQUIREMENTS (15)** 2.1 Requirements of an industry – location – water – industrial water treatment – safety measures - pilot plants. 2.2 Fuels types of fuels with examples - coal - carbonization of coal - coal tar distillation - liquid fuels - gaseous fuels - selection of fuels - nuclear fuels. Energy - sources of energy-renewable and non-renewable energies - non conventional energies. 2.3 Industrial catalysts - Types of catalysts - Functions and applications of Raney Nickel, Pd, $CuCrO_4$, TiO_2, Al, V and Pt based catalysts and zeolites.	**15**	**CO1,**
2	**UNIT 2: PETROCHEMICAL INDUSTRIES (15)** 2.1 Crude oil - constitution and distillation - composition of different distillates - pour points, depressants, drag reducers, viscosity reducers, ignition point, flash point octane number – cracking - catalysts used in petroleum industries - structure selectivity and applications. 2,2 Manufacture of synthetic petrol - Dergius and Fischer Tropsh processes - Manufacture of petrochemicals and petrochemical polymers. 2,3 Manufacture of higher olefins, Acetaldehyde, Acetic acid, Ethylene glycol, glycerine, Acetone, phenol, carbon disulphide, vinylacatate, Cumene, chlorophrenes, Butane diols, Xylenes, Lineral alkyl benzenes and their Sulphonates	**15**	**CO2,**
3	**UNIT 3: FERTILIZERS AND SPECIALITY CHEMICALS (15)** 1.1 Manufacture - Properties and industrials uses of solvents – DMF, DMSO, THF and Diozane.	**15**	**CO3,**

	1.2 Fertilizers – Raw materials, manufacture (flow chart chemical process with equations) of ammonium nitrate, ammonium sulphate, urea, calcium cyanamide, calcium ammonium nitrate, sodium nitrate, ammonium chloride, ammonium phosphate, super phosphate of lime, NPK fertilizers. 3.3 Manufacture in pure form of the following - Sodium carbonate, Oxalic acid, Potassium dichromate, Perchloric acid.		
4	**UNIT 4: OILS, SOAPS AND DETERGENTS (15)** 4.1 Manufacture of Cl_2, NaOH nad Chlorates of Na and K – manufacture of perchlorate. Oils - difference between oils and fats - manufacture of cotton seed oil and soybean oil - refining of oil - manufacture of soaps - toilet and transparent soaps. 4.2 Detergents - synthetic detergents -surface active agents and their classification - manufacture of anionic, cationic and non-ionic detergents and shampoo. 4.3 Sugar industry - manufacture of sugar from cane sugar and beet root. Manufacture of leather - hides - Vegetable and chrome tanning finishing. 4.4 Manufacture of DDT, dinitrophenols, BHC, gamaxane, malathion, parathion, and dementon.	**15**	**CO4,**
5	**UNIT 5: METALLURGY (15)** 5.1 General methods of metallurgy – ores - types methods of concentration of ores- hydro metallurgy, phyrometallurgy - various of reduction of methods, refining of metals. 5.2 Extraction of Cr, Mn, V, Co, Pt, U and Th. 5.3 Environmental problems of chemicals industries – methods of control - sewage treatment and waste management. Man power in chemical industries - labour problems - Six Sigma (Basic concept only).	**15**	**CO5**

Books for Reference

1) Sharma B. K. Industrial Chemistry, Geol publishing House, 2003, Meerut.
2) Drydense C.E, Outlines of Chemical Technology. Gopala rao, Eastwest press, New Delhi
3) Shreve RV, Chemical Process Industries, TataMc Graw Hill publishing company, Mumbai
4) Steines H., Introduction to petrochemicals, Pergaman Press.
5) Alan Cottrel, An introduction to Metallurgy. Orient Longman (2000)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Course Title: ELECTIVE III PHYSICAL CHEMISTRY PRACTICALS

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	derive kinetic equations and investigate the reaction rate
CO2	construct phase diagram & determine the eutectic composition and temperature
CO3	compute the colligative properties such as depression of freezing point & cryoscopic constant
CO4	predict the transition temperature of hydrated salts
CO5	apply Nernst distribution law and calculate equilibrium constant
CO6	determine the miscibility temperature of phenol–water system and study the effect of impurity to CST

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**
CO6	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	LIST OF EXPERIMENTS	Hrs	COs
1	1. *Determination of Critical Solution Temperature 2. Effect of Impurity on Critical Solution Temperature 3. Determination of Transition Temperature 4. Determination of K_f and molecular weight by Rast Method 5. Kinetics of Acid Catalysed Hydrolysis of Ester (First order kinetics) 6. Kinetics of Iodination of Acetone (Zero order kinetics) 7. Kinetics of Persulphate-Iodide Reaction (Second order kinetics) 8. Determination of Partition Coefficient of Iodine between CCl_4 and water. 9. *Determination of Equilibrium constant of $KI + I_2 = KI_3$ 10. *Phase Diagram (Simple Eutectic System) 11. *Determination of Viscosity 12. * Determination of Association factor of Benzoic acid * Not to be given for examination	**9**	**CO1, CO2, CO3, CO4, CO5 & CO6**

TEXT & REFERENCE BOOKS:

1. Venkateswaran, V. Veeraswamy,R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997)
2. Daniels et al., Experimental Physical Chemistry, VII Edn, New York, McGraw Hill, (1970)
3. Findley, A., Practical Physical Chemistry, VII Edn., London, Longman (1959)
4. Ahluwalia, V.K., Dingra, S and Gulati, A. College Practical Chemistry, Orient Longman Pvt. Ltd., Hyderabad (2005)
5. Sharma, K. K. and Sharma, D.S. Introduction to Practical Chemistry, Vikas Publishing House, New Delhi, (2005)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

Course Title: ELECTIVE III POLYMER CHEMISTRY

Course Code :	**Credits : 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

COs	Learning objectives
01	To know the types of polymers and the chemistry of polymerization K2
02	To understand the physical properties of polymers, their reactions and degradation K3
03	To acquire knowledge about the polymerisation techniques and polymer processing. K3
04	To know the chemistry of individual polymers, their preparation properties K3
05	To have an idea about the recent advances in polymer science. K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	2	2	3	1	3	3	3	2	3
CO2	3	3	3	2	2	2	3	1	3	3	3	2	3
CO3	3	3	3	2	2	2	3	1	3	3	3	2	3
CO4	3	3	3	2	2	2	2	2	3	3	3	2	3
CO5	3	3	3	2	2	2	2	2	3	3	3	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S No	CONTENTS OF MODULE	Hrs	Cos
1	**UNIT 1: INTRODUCTION TO POLYMERS (15)** 1.1 Importance of polymers: Basic concept - Monomers and polymers – definition. 1.2 Classification of polymers on the basis of microstructure, macrostructures and applications (thermosetting and thermoplastic) Distinction among plastics, elastomers and fibres. Homo and heteropolymers - copolymers. 1.3 Chemistry of polymerization - Chain polymerisation, Free radical, ionic, coordination, step Polymerisation. Polyaddition and polycondensation miscellaneous ring-opening and group transfer polymerization	**15**	**CO1**
2	**UNIT 2: PHYSICAL PROPERTIES AND REACTIONS OF POLYMERS (15)** 2.1 Properties : Glass transition temperature (Tg) - Definition - Factors affecting Tg - relationship between Tg and molecular weight and melting point. Importance of Tg. 2.2 Molecular weight of polymers: Number average, weight average, sedimentation and viscosity average molecular weight. Molecular weights and degree of polymerization. 2.3 Reactions: hydrolysis - hydrogenation - addition - substitutions - cross-linking vulcanisation and cyclisation reactions. 2.4 Polymer degradation. Basic idea of thermal photo and oxidative degradation of polymers.	**15**	**CO2**
3	**UNIT 3: POLYMERIZATION TECHNIQUES AND PROCESSING (15)** 3.1 Polymerisation techniques: Bulk, solution, suspension, emulsion, melt condensation and interfacial polycondensation polymerization. 3.2 3.2 Polymer processing: Calendaring - die casting, rotational casting compression. Injection moulding.	**15**	**CO3**
4	**UNIT 4: CHEMISTRY OF COMMERCIAL POLYMERS (15)**	**15**	**CO4**

	4.1 General methods of preparation, properties and uses of the following Polymers: Teflon, polymethyl methacrylate. Polyethylene, polystyrene, PAN. 4.2 polyesters, polycarbonates, polyamides (Kevlar), polyurethanes, PVC, epoxy resins, rubber-styrene and neoprene rubber, Phenol - formaldehyde and urea - formaldehyde resins.		
5	**UNIT 5: ADVANCES IN POLYMERS** 5.1 Biopolymers - biomaterials. Polymers in medical field. High temperature and fire-resistant polymers. 5.2Silicones. Conducting - carbon Fibers. (basic idea only).	**15**	**CO5**

TEXT BOOK

Billmeyer F.W., Text book of polymer science, Jr. John Wiley and Sons, 2010.

Books for Reference

1. Gowariker V.R., Viswanathan N.V. and Jayader Sreedhar, Polymer Science, Wiley Eastern Ltd., New Delhi, 1978.
2. Sharma, B.K., Polymer Chemistry, Goel Publishing House, Meerut, 1989.
3. Arora M.G., Singh and Yadav M.S., Polymer Chemistry, 2nd Revised edition, Anmol Publications Private Ltd., New Delhi, 1989.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

ELECTIVE IV

Course Title: INORGANIC CHEMISTRY PRACTICALS - GRAVIMETRIC ANALYSIS AND INORGANIC CHEMISTRY COMPLEX PRPARATION

Course Code :	**Credits : 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

Learning objective:

The objective of the course is to equip the students to determine the amount of ions present in precipitate and preparation of various inorganic complexes.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To determine amount of analyte to get precipitate.
CO2	To predict the percentage of analyte precipitate
CO3	Student can able to explain why is gravimetric analysis is more accurate than volumetric analysis
CO4	The students will get training in the quantitative analysis of metal ions and anions using gravimetric method.
CO5	Determination of purity and thermal stability of both the primary and secondary standard
CO6	Determination of composition of complex mixture
CO7	Studying the sublimation behavior of various mixture and in gravimetric sample preparation, both solids and solvents are weighed to prepare specific, precise concentration, which help minimize out of specification error

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO								**PSO**				
	1 (KB)	**2** CT	**3** PS	**4** TO	**5** **com**	**6** LLL	**7** ETHIC	**8** IND	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
CO2	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**2**	**3**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
CO4	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**

CO5	**3**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO6	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO7	**3**	**2**	**3**	**3**	**1**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S No	**CONTENTS OF MODULE**	**Hrs**	**Cos**
1	Estimation of sulphate as barium sulphate	**3**	**CO1**
2	Estimation of barium as barium sulphate	**3**	**CO2**
3	Estimation of lead as lead chromate	**3**	**CO3**
4	Estimation of calcium as calcium oxalate monohydrate	**3**	**CO3**
5	Estimation of nickel as $Ni(DMG)_2$ complex.	**3**	**CO4**
6	Estimation of Barium as Barium chromate	**3**	**CO4**
7	Estimation of Magnesium as Magnesium oxinate by precipitation from homogenous solution.	**3**	**CO5**
8	**PREPARATION OF INORGANIC COMPLEXES** (i) Tetrammine copper (II) sulphate (ii) Potassium trisoxalatochromate (III) (iii) Hexamminenickel (II) chloride	**3**	**CO6 &CO7**

REFERENCE BOOKS:

1. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984)
2. Venkateswaran, V. Veeraswamy,R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

Course Title: ELECTIVE PAPER V ORGANIC CHEMISTRY PRACTICALS I

Course Code :		**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

LEARNING OUTCOMES:

They will learn some important organic reaction & analysis the presence of functional groups.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	They can able to analysis simple organic compounds (mono & bi functional groups) qualitatively
CO2	They can able to prepare simple organic compounds by using FGI, Functional Group Inter conversion.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE		COs
1	**Organic analysis** Systematic analysis of organic compounds containing mono/ bifunctional group and characterization by confirmatory tests.,.Aldehyde (aromatic), ketone, ester, nitro compounds, Carbohydrate (reducing sugars only), Carboxylic acid (both saturated and unsaturated),dicarboxylic acid, Phenol, Aromatic Amine, Aliphatic Diamide., aromatic monoamide, anilides containing one functional group and characterization by confirmatory tests.		**CO1, CO2**
2	Preparation of organic compounds involving the following chemical conversions, oxidation (benzaldehyde to benzoic acid), esterification(2-napthol to 2-napthyl benzoate), hydrolysis(methyl salicylate to salicyclic acid), nitration(phenol to 2,4,6-tribromo phenol), bromination(aniline to tribromo aniline), diazodization(preparation of methyl orange), osazone formation(preparation of glucosazone).		**CO1, CO2**

Books for reference

1. Venkateswaran, V. Veeraswamy,R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997)

2. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

SKILL ENHANCEMENT COURSE

Course Title: ANALYTICAL CHEMISTRY PRACTICALS

Course Code	**:**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Learning objective:

The objective of the course is to equip the students to measure conductance, apply the concept of potential difference to carry out titrations and to calculate thermodynamic parameters, measure absorption using colorimeter and verify and apply the Lambert-Beer law.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Determine the cell constant and explain the effects of dilution on equivalent and molar conductance.
CO2	Carry out conductometric titrations to determine the concentration of unknown acids
CO3	Learnt to use the potentiometer and carryout potentiometric titrations for acid base and redox reactions.
CO4	They learnt to use colorimeter and measure absorption to find the unknown concentrations of the given solutions.
CO5	Identify the number of components in a mixture using TLC and column chromatography.
CO6	Use polarimeter to measure specific rotation of an optically active compound such as sucrose and calculate the concentration.
CO7	Determine the thermodynamic parameters of a reaction in the Daniel cell using potentiometer.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO7	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S No	CONTENTS OF MODULE	Hrs	COs
1	**Conductometry** a) Determination of Cell constant **b)** Determination of Specific conductance, Molar conductance, equivalent conductance and Verification of Onsager equation	**8**	**CO1**
2	**Conductometry** Determination of strength of given strong acid using strong base	**6**	**CO2**
3	**Potentiometric titrations** Determination of strength of a strong acid using strong base.(HCl Vs. NaOH)	**10**	**CO3**
4	**Potentiometric titrations** Redox titrations. ($K_2Cr_2O_7$ Vs $FeSO_4$)	**9**	**CO3**
5	**III Colorimetry** Estimation of Iron	**7**	**CO4**
6	**III Colorimetry** Estimation of Copper	**7**	
7	**Chromatographic techniques*:** Thin layer chromatography: Determination of R_f value of Ni and Co, Cu ions	**7**	**CO5**
8	**Chromatographic techniques*:** Column chromatography: Separation of mixture of organic compounds into single components (Demonstration only)	**8**	**CO5**
9	Estimation of Glucose by Polarimetric method	**6**	**CO6**
10	Determination of Thermodynamic properties for the cell reaction in a Daniel Cell by potentiometer	**7**	**CO7**

REFERENCE BOOKS:

1. Venkateswaran, V. Veeraswamy,R.Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997).

2. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984)

3. Practical physical chemistry, Alexander Findley.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

oom's Category	MODEL	ESE
arks (out of 50)	60	60
emember		
nderstand		
pply	30	30
nalyze	30	30
valuate		
eate		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
emember	
nderstand	
pply	50
nalyse	50
valuate	
eate	

OPEN ELECTIVE PAPER

CHEMISTRY IN EVERYDAY LIFE

LEARNING OBJECTIVES:

This course aims to explain the biggest role of chemistry (a branch of Science) employed in different spheres of human life such as the air we breathe, the water we use, the various cosmetic products used every day, building materials we use for construction purposes, common pharmaceutical drugs we intake, fuel studies, colour compositions of dyes and pigments and chemical fertilizers we depend on for good yield in food production.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define hardness of water and chemical methodologies to get rid of the same.
CO2	Summarise the air pollutants which causes air pollution and their impact in human life.
CO3	Quote the significant role of cement, ceramics, glass and refractories.
CO4	Recall the product used in daily life with a correlation to the polymer studies.
CO5	Assess the chemical formulations of cosmetic products used in industries and their hazards.
CO6	Compare the importance of chemical fertilizers over natural fertilizers and the risks involved in using chemical fertilizers.
CO7	Compare the solid, liquid and gaseous fuel with illustration in accordance with natural and artificial sources.
CO8	Recall the chemical composition of colour pigments and dyes.
CO9	Predict the chemical formulation of drugs which are commonly used for fever and to relieve pain.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO7	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO8	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO9	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1** General survey of chemicals used in everyday life. Air components and their importance; photo synthetic reaction, air pollution, green house effect and their impact on our life style. Water – sources of water, qualities of potable water, soft and hard water, and method of removal of hardness – water pollution.	**6**	**CO1 &CO2**
2	**Unit 2**	**6**	**CO3&CO4**

	Building materials – cement, ceramics, glass and refractories – definition composition and application only. Plastics polyethylene, PVC, Bakelite, polyester, melamine formaldehyde resin- preparation and uses only		
3	**Unit 3** Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes- general formulation and preparation- possible hazards of cosmetic use.	**6**	**CO5**
4	**Unit 4** Chemicals in food production – fertilizers- need, natural sources; urea, NPK fertilizers and super phosphate. Fuel- classification – solid, liquid and gaseous: nuclear fuel- examples and uses.	**6**	**CO6 & CO7**
5	**Unit 5** Pharmaceutical drugs- analgesics and antipyretics- paracetomol and aspirin. Colour chemicals- pigments and dyes- examples and applications.	**6**	**CO8 & CO9**

REFERENCE TEXT BOOKS

1. R.Norrish.,Chemical process industries (4^{th} edition).
2. Snyder C.H., The extraordinary chemistry of ordinary things; John Wiley &Sons, Newyork.
3. Selinger B.K., Chemistry in the market place; Sydney 1998.
4. G.D.Gem Mathew., Chemistry in Everyday life.
5. Manahan S.E general applied chemistry., PWS Publishers.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

OPEN ELECTIVE PAPER
FOOD ADDITIVE CHEMISTRY AND FIVE BASIC SENSES

LEARNING OBJECTIVES:

This course aims to explain the approach of food additives which are the essential part of contemporary food system. These additives stimulate the sensory organs and enables nerves to relay signals to the brain. Wherein, its interpretations make commercial products more attractive for the consumers.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explain the glazing agent from natural and nature -mimic sources and food products which are coated with these glazing agents.
CO2	Summarise the list of natural, artificial and spurious colourants used in food products
CO3	Quote the mechanism of sound and digestion correlations
CO4	Recall the role of emulsifiers, stabilizers and thickeners which gives required texture and consistency for food.
CO5	Assess the sweetener in terms of Structure Activity Relationship (SAR) with respective to its taste.
CO6	Compare the type of flavourants as natural, nature-identical, artificial flavouring substances.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	3	2	2	3	3	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	2	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	3	2	3	3
CO6	3	3	3	2	3	3	3	3	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1** **SIGHT (OPHTHALMOCEPTION):** Introduction- Food Colours-Natural Colourants-Synthetic Colours-Spurious Colours -Glazing Agents	**6**	**CO1&CO2**
2	**UNIT 2** **SMELL (OLFACCEPTION):** Introduction- Flavours-Flavourants –Types- Synthetic Food Flavours- Flavour Enhances –Mono Sodium Glutamate-Vinegar	**6**	**CO6**
3	**UNIT 3** **TASTE (GUSTAOCEPTION):**	**6**	**CO5**

	Introduction –Nutritive And Non-Nutritive Sweetners- Chemistry of Sweeteners- Artificial Sweetners- Saccharin- Effect of Substitution and Taste- Cyclamate-Aspartame- Health effects		
4	**UNIT 4** **HEARING (AUDIOCEPTION)** Introduction - Sound and Digestion –Vagus Nerve- Abdonominal/Bowel Sounds –Symptoms and Remedies	**6**	**CO3**
5	**UNIT 5** **TOUCH (TACTIOCEPTION):** Introduction -Emulsifiers -Definition- Examples–Stabilizers- Definition- Examples -Thickeners Definition- Examples	**6**	**CO4**

References

1. Snyder C.H., The extraordinary chemistry of ordinary things; John Wiley &Sons, Newyork.
2. G.D.Gem Mathew., Chemistry in Everyday life.
3. Swaminathan.M.,Food Sciences and Experimental foods, Ganesh and Company.
4. Srilakshmi.B., Food Science (4^{th} edition)., New Age International Pvt Ltd.,

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

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Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

OPEN ELECTIVE PAPER

FOOD CHEMISTRY

LEARNING OBJECTIVES:

This course aims to explain the scientific approach of adulterants present in food and inevitable role of food additives which are used in food products incidentally and intentionally.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define the basic difference between oils and fats in terms of structural terminology.
CO2	Summarise the concepts of MUFA and PUFA for its pivotal role in preventing heart diseases.
CO3	Quote the role of additives like artificial sweetener, food colourants and flavouring agents and preservatives in food products.
CO4	Explain the importance of first aid to be given to a poison consumed victim.
CO5	Apply the knowledge of various chemical poisoning substances which are ingested in the food every day.
CO6	Explain the use of alcoholic and non-alcoholic beverages in everyday life.
CO7	Solve the adulteration related issues of food items by simple qualitative chemical test.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO7	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1:** Sources of food, types - Food adulteration- common adulterants – contamination of wheat, rice, dhal, milk, butter, ghee adulterants - Detection of adultered foods by simple analytical techniques.	**6**	**CO7**
2	UNIT 2: Food poisons- pesticides, DDT, BHC, and Malathion – chemical poisons- first aid for poison consumed victims	**6**	**CO4&CO5**
3	UNIT 3: Food additives- artificial sweetners- saccharin-cyclamate and aspartame.Food flavours- esters, aldehydes and heterocyclic compound. Food colours- emulsifying agents-preservatives- leavening agents. Baking powder- yeast- taste makers- MSG, vinegar.	**6**	**CO3**
4	UNIT 4: Beverages- soft drinks- soda- fruit juices- alcoholic beverages examples. Carbonation- addiction to alcohol- diseases of liver and social problems	**6**	**CO6**
5	UNIT 5: Fats, oils – sources of oils – production of refined vegetable oils- preservation. Saturated and unsaturated fats-iodine value- role of MUFA PUFA in preventing heart diseases-determination of iodine value, RM value, Saponification values and their significance.	**6**	**CO1 &CO2**

References:

1. Swaminathan.M.,Food Sciences and Experimental foods, Ganesh and Company.
2. Srilakshmi.B., Food Science (4th edition)., New Age International Pvt Ltd.,
3. G.D.Gem Mathew., Module1-Chemistry in everyday life.,
4. Manahan S.E general applied chemistry., PWS Publishers.
5. Seager S.L and Slabaugh M.R., Organic and biochemistry for today.

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